

TITLE OF THE INVENTION

ASSEMBLY INFORMATION MANAGEMENT SYSTEM AND  
CLIENT/SERVER DISTRIBUTION SYSTEM  
FOR ASSEMBLY INFORMATION MANAGEMENT

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FIELD OF THE INVENTION

The present invention relates to an assembly information management system for assembly information management in, e.g., an assembly workshop, and a  
10 client/server distribution system for assembly information management.

BACKGROUND OF THE INVENTION

To assemble a product from parts, an enormous number  
15 of parts are required. The larger the number of parts becomes,  
the more enormous and complex the works become.

Conventionally, an experienced chief of the workshop,  
who knows the enormous number of complex works well manually  
arranges the works, calculates the manhour, and assigns  
20 operators in units of manhours.

However, this manual composing operation accompanies  
poor maintenance because it is not only time-consuming but  
also difficult to correct and can be understood only by the  
creator.

25

SUMMARY OF THE INVENTION

The present invention has been made to solve the above problem, and has as its object to propose an assembly information management system and a client/server distribution system for assembly information management, 5 which can convert the work standard into a standard format easy to compute and also manage the work standard data.

In order to achieve the above object, an assembly information management system according to the present invention is characterized by having the following 10 arrangement.

More specifically, there is provided an assembly information management system for creating/editing/managing work standard data related to an assembly work of various goods to manage the assembly work of the goods, characterized 15 by comprising:

a work standard creation subsystem (2800) for describing a work related to a work standard using an operation phrase representing an operation of the work, an object phrase representing a target of the operation, and 20 a comment phrase representing auxiliary information related to the operation and/or object to create each work standard data;

a standard manhour database (3601) having records each constituted by a work standard described by an operation 25 phrase, object phrase, and comment phrase and a standard manhour of the work standard;

- THE INFORMATION CONTAINED  
HEREIN IS UNCLASSIFIED
- a standard manhour setting subsystem (2801) connected to the work standard creation subsystem and the standard manhour database, the standard manhour setting subsystem being adapted to execute matching search for each of a first 5 work standard group of manhour setting targets downloaded from the work standard creation subsystem while referring to a phrase portion of each record of the standard manhour database and assign the searched standard manhour of the work standard as a set manhour; and
- 10 a work assignment subsystem (2802) capable of inputting data of a predetermined composition condition, the work assignment subsystem being adapted to download a second work standard group with manhour data from the standard manhour setting subsystem and divisionally compose the work 15 standards of the second work standard group to a plurality of stations on the basis of a composition condition.

Thus, all work standards are standardized by elements such as the operation phrase, object phrase, and comment phrase. A standard manhour is given to the standardized work 20 standard, and works are composed on the basis of this manhour.

The three subsystems can be arbitrarily integrated/divided. Hence, according to a preferred aspect, an assembly information management system for creating/editing/managing work standard data related to an 25 assembly work of various goods to manage the assembly work of the goods may comprise:

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a standard manhour database (3601) having records each constituted by a work standard described by an operation phrase, object phrase, and comment phrase and a standard manhour of the work standard;

- 5        a work standard creation/manhour setting subsystem (2800, 2801) connected to the work standard creation subsystem and the standard manhour database, the standard manhour setting subsystem being adapted to describe a work related to a work standard using an operation phrase
- 10      representing an operation of the work, an object phrase representing a target of the operation, and a comment phrase representing auxiliary information related to the operation and/or object to create each work standard data, execute matching search for each of a first work standard group of
- 15      manhour setting targets while referring to a phrase portion of each record of the standard manhour database, and assign the searched standard manhour of the work standard as a set manhour; and

- 20      a work assignment subsystem (2802) capable of inputting data of a predetermined composition condition, the work assignment subsystem being adapted to download a second work standard group with manhour data from the work standard creation/manhour setting subsystem and divisionally compose the work standards of the second work standard group to a plurality of stations on the basis of a composition condition.

According to another preferred aspect, an assembly information management system for creating/editing/managing work standard data related to an assembly work of various goods to manage the assembly work of the goods may comprise:

- 5        a work standard creation subsystem (2800) for describing a work related to a work standard using an operation phrase representing an operation of the work, an object phrase representing a target of the operation, and a comment phrase representing auxiliary information related
- 10      to the operation and/or object to create each work standard data;
- 15      a standard manhour database (3601) having records each constituted by a work standard described by an operation phrase, object phrase, and comment phrase and a standard manhour of the work standard; and
- 20      a standard manhour setting/work assignment subsystem (2801, 2802) capable of inputting data of a predetermined composition condition and connected to the work standard creation subsystem and the standard manhour database, the standard manhour setting/work assignment subsystem being adapted to execute matching search for each of a first work standard group of manhour setting targets downloaded from the work standard creation subsystem while referring to a phrase portion of each record of the standard manhour
- 25      database, assign the searched standard manhour of the work standard as a set manhour, and divisionally compose the work

standards of the work standard group assigned the manhours to a plurality of stations on the basis of a composition condition.

The subsystem preferably has a client/server structure.

- 5 Hence, there is provided a client/server distribution system for assembly information management, comprising the subsystem, and a common memory (2805) connected to the subsystem to read out or store the work standard group.

According to another assembly information management  
10 system as a preferred aspect of the present invention, data of the work standard group to which the manhours are given by the standard manhour setting subsystem is uploaded to the work standard creation subsystem.

According to still another assembly information  
15 management system as a preferred aspect of the present invention, the work standard group composed by the work assignment subsystem is uploaded to the work standard creation subsystem together with station information accompanying the work standards.

20 In operating the assembly information management system of the present invention in a country of a different language, the system is characterized in that the operation phrase, object phrase, and comment phrase in each record of the standard manhour database are translated to a  
25 predetermined language,

the work standard creation subsystem further comprises

a translation subsystem (2803) for translating each phrase of the first work standard group to the predetermined language, and

the standard manhour setting subsystem searches and  
5 matches each phrase of the first work standard group, which is already translated and downloaded from the work standard creation subsystem with the translated phrase of each record of the standard manhour database.

When the subsystem has a standalone structure,  
10 according to still another preferred aspect of the present invention, the work standard creation subsystem is characterized in that the system attaches predetermined image data to the data of the first work standard group, has a memory for storing the work standard data having the image  
15 data, downloads information of a composition result by the work assignment subsystem from the work assignment subsystem, and merges the composition result with the image data in the memory.

Similarly, when the subsystem has a standalone structure, according to still another preferred aspect of the present invention, the work standard creation subsystem is characterized in that the system attaches predetermined voice data to the data of the first work standard group, has a memory for storing the work standard data having the voice  
25 data, downloads information of a composition result by the work assignment subsystem from the work assignment subsystem,

and merges the composition result with the voice data in the memory (Fig. 88).

In still another preferred aspect of the present invention, a workstation for each composed station is  
5 connected to the client/server distribution system.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts  
10 throughout the figures thereof.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing the hardware configuration of an assembly standard information management system  
15 according to an embodiment;

Fig. 2 is a view showing the relation structure of a representative model record, process (arrangement) record, and work standard record;

Fig. 3 is a view for explaining a window in which work  
20 standard data is to be input in the work standard system;

Fig. 4 is a view showing the linkage between master data files in the work standard system;

Fig. 5 is a flow chart for explaining the procedure of inputting work standard data;

25 Fig. 6 is a view for explaining a window for inputting data to the "applied model" field;

Fig. 7 is a view for explaining another method of inputting a model name to an applied model field 302;

Fig. 8 is a view for explaining reference input of data related to a part;

5 Fig. 9 is a view for explaining incremental search input of data related to a work;

Fig. 10 is a view for explaining incremental search input of data related to a work;

10 Fig. 11 is a view for explaining a window in which data related to a work is to be input;

Fig. 12 is a view for explaining reference input in inputting work data;

Fig. 13 is a view for explaining the reference input function in inputting "verb" in the work procedure;

15 Fig. 14 is a flow chart showing the control procedure in inputting data on the basis of the work procedure input window shown in Fig. 11;

Fig. 15 is a view for explaining an example of a plurality of input work procedures;

20 Fig. 16 is an explanatory view of the reference input function in inputting a note;

Fig. 17 is an explanatory view of the reference input function in inputting a note;

25 Fig. 18 is an explanatory view of various menus for editing the work procedure itself;

Fig. 19 is a view for explaining operation of

exchanging two work procedures;

Fig. 20 is a view for explaining operation of  
exchanging two work procedures;

Fig. 21 is an explanatory view of a menu for storing  
5 a created work;

Fig. 22 is a view showing a menu window for opening  
a work to be edited in editing the work standard;

Fig. 23 is a view for explaining a plurality of works  
opened by the menu shown in Fig. 22;

10 Fig. 24 is a view for explaining a menu window for  
executing an image editing function;

Fig. 25 is a view for explaining an input field to which  
an image to be attached is to be loaded;

15 Fig. 26 is a view showing an image attached to the work  
standard data;

Fig. 27 is a view showing a menu window for selecting  
a tool to edit an image;

Fig. 28 is a view for explaining positioning of a  
translation subsystem in the work standard creation system;

20 Fig. 29 is a view for explaining a start menu for  
starting translation;

Fig. 30 is a view showing a window for selecting a work  
standard to be translated;

25 Fig. 31 is a view for explaining a state wherein the  
work standard to be translated and an English equivalent are  
displayed on opposite sides;

Fig. 32 is a view for explaining a state wherein the work standard to be translated and an English equivalent are displayed on opposite sides;

5 Fig. 33 is a view for explaining a menu window for activating playback of voice data attached to the work standard;

Fig. 34 is a view for explaining a menu window for activating voice data recording;

10 Fig. 35 is a view showing the storage positions of files in a work standard creation system 2800 and translation system 2803;

Fig. 36 is a view for explaining the file structure of a standard manhour setting system 2801 of the embodiment in the form of blocks;

15 Fig. 37 is a view for explaining the data structure of a manhour setting file 3601;

Fig. 38 is a view for explaining the data structure of a standard data file 2804;

20 Fig. 39 is a view showing the directory structure in the standard data file 2804;

Fig. 40 is a view for explaining three routes of manhour setting in the standard manhour setting system 2801;

Fig. 41 is a view for explaining the outline of data load in the standard manhour setting system 2801;

25 Fig. 42 is a view for explaining the first route for setting the manhour on the basis of data from a standard

material data file;

Fig. 43 is a view for explaining the second route for setting the manhour on the basis of data from an operation pattern data file;

5 Fig. 44 is a view showing a manhour setting file 3601;

Fig. 45 is a view for explaining the initial menu window of the standard manhour setting system 2801;

10 Fig. 46 is a view for explaining the window structure for defining the data range to be loaded in the standard manhour setting system 2801;

Fig. 47 is a view showing the list of work data defined by the window shown in Fig. 46;

Fig. 48 is a view for explaining the data load window;

15 Fig. 49 is a view for explaining that arbitrary works can be grouped by arbitrarily changing the hierarchical structure of directories in the standard manhour setting system 2801;

Fig. 50 is a view for explaining the file structure of the standard manhour setting system 2801;

20 Fig. 51 is a flow chart for explaining the control procedure of the standard manhour setting system 2801;

Fig. 52 is a view for explaining a user interface window for selecting a "product" as a manhour setting target;

25 Fig. 53 is a view for explaining another user interface window for selecting a "product" as a manhour setting target;

Fig. 54 is a view for explaining the "model" selection

window;

Fig. 55 is a view for explaining the dialog for selecting a "work" to be edited;

Fig. 56 is a view for explaining a work loaded by  
5 selection in Fig. 55;

Fig. 57 is a view for explaining the analysis material editing window;

Fig. 58 is a view for explaining a user interface window for selecting a work to be analyzed;

10 Fig. 59 is a view for explaining a user interface window for displaying representative WFs (Work Factors) that can be selected by the user;

Fig. 60 is a view showing a user interface window so as to explain the manhour definition of PU (pick up)  
15 operation;

Fig. 61 is a view showing a user interface window so as to explain the manhour definition of TURN (direction changing) operation;

Fig. 62 is a view for explaining a window for inquiring  
20 the change reason for the manhour of a specific work;

Fig. 63 is a view showing a window for displaying the change reason for the manhour;

Fig. 64 is a view for explaining the basic operation of a work assignment system 2802;

25 Fig. 65 is a view for explaining the file structure of the work assignment system 2802;

Fig. 66 is a view for schematically explaining the work composition in the standard manhour setting system 2801;

Fig. 67 is a view for explaining a window for displaying original data of simple division or parallel  
5 division in the standard manhour setting system 2801;

Fig. 68 is a view for explaining the work contents of stations divided by simple division;

Fig. 69 is a view for explaining a user interface window in further editing the workshop divided by simple  
10 division;

Fig. 70 is a view for explaining a user interface window for defining the parallel operation between works in parallel division;

Fig. 71 is a view for explaining a plurality of  
15 composition plans created by parallel division;

Fig. 72 is a view for explaining a user interface window in further editing composition plan 1 created by parallel division;

Fig. 73 is a view for explaining a user interface window in further editing composition plan 2 created by  
20 parallel division;

Fig. 74 is a view for explaining a user interface window for defining a load target in loading data from the standard manhour setting system 2801 in the work assignment  
25 system 2802;

Fig. 75 is a view for explaining the reason why the

data load range can be changed and defined in various ways in the work assignment system 2802;

Fig. 76 is a view for explaining a user interface window in opening an existing file in a composition table  
5 file 6400;

Fig. 77 is a view for explaining a state wherein the work data loaded in the memory of the work assignment system 2802 are displayed for each "target model";

Fig. 78 is a view for explaining a user interface  
10 window in adding a work in the standard manhour setting system 2801;

Fig. 79 is a flow chart for explaining the control procedure of simple division by the work assignment system 2802;

15 Fig. 80 is a view for explaining the states of five stations divided by simple division by the work assignment system 2802;

Fig. 81 is a view for explaining work division in the stations in the work assignment system 2802;

20 Fig. 82 is a view showing a state wherein a work having a large manhour is assigned to station 2 to be parallel-operated in the workshop having five stations so as to explain work assignment;

Fig. 83 is a view for explaining the work division  
25 result in the stations in the work assignment system 2802;

Fig. 84 is a view for explaining a user interface

window for station division in the work assignment system  
2802;

Fig. 85 is a view for explaining a user interface window for adding or inserting a station in the work assignment system 2802;

Fig. 86 is a view for explaining a method of displaying a station to which a work having a large manhour is assigned by the work assignment system 2802;

Fig. 87 is a view for explaining an authentication window for authenticating a user who will compose works;

Fig. 88 is a block diagram for explaining the overall arrangement of a system according to a modification in which each subsystem has a standalone structure;

Fig. 89 is a view for explaining a state wherein operations of each of a plurality of works, and images and parameters corresponding to the respective operations are related to each other and stored;

Fig. 90 is a view showing images (images representing a continuous operation) continuously generated by designating parameters in accordance with the method shown in Fig. 89;

Fig. 91 is a view showing a dialog box for inputting a component symbol in relation to Fig. 39;

Fig. 92 is a view showing a user interface window for grouping a plurality of works in composing works;

Fig. 93 is a view showing a user interface window for

grouping a plurality of works in composing works;

Fig. 94 is a view showing a user interface window for grouping a plurality of works in composing works;

Fig. 95 is a flow chart for explaining a control  
5 procedure for work assignment as a modification to Fig. 79,  
i.e., a composition \_control procedure that the number of  
stations assigned works preferentially should not exceed the  
number of stations  $N_{st}$ ;

Fig. 96 is a flow chart for explaining a control  
10 procedure for work assignment as another modification to  
Fig. 79, i.e., a composition control procedure for  
preferentially averaging the manhours of works assigned to  
stations; and

Fig. 97 is a view showing the state of  
15 parallel-operated station 2 in the workshop of the example  
shown in Fig. 85.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment in which the present invention is applied  
20 to a printer manufacturing process will be described below  
in detail with reference to the accompanying drawings.

The overall system to be described in this embodiment  
is called an "assembly standard information management  
system". As shown in Fig. 28, this assembly standard  
25 information management system comprises three subsystems:  
· work standard creation subsystem 2800,

- standard manhour setting subsystem 2801, and
- work assignment subsystem 2802

In the following explanation, these subsystems will be referred to as the work standard creation system 2800,

5 standard manhour setting system 2801, and work assignment system 2802, respectively, for the descriptive convenience.

The work standard creation system 2800 creates (defines) a work standard (work standard data) for the standard manhour setting subsystem 2801 and work assignment subsystem 2802. In the work standard creation system 2800, 10 the user is required to understand, for each work to be executed in the manufacturing process, a "verb" representing an operation of the work, an "object" that describes the target of the work, and some "comments" and also have knowledge for the manufacturing process enough to 15 sequentially describe the flow of the series of works.

The standard manhour setting system 2801 determines the standard manhour for the work standard created by the work standard creation system 2800.

20 The work assignment system 2802 determines composition (work composition) using the work standard created by the work standard creation system 2800.

#### <Overall Arrangement>

Fig. 1 shows the hardware configuration of the 25 assembly standard information management system. As shown in Fig. 1, this assembly standard information management

system has a plurality of clients and one server (or a plurality of servers). The computer system of each client (to be referred to as a client system hereinafter) has, e.g.,

- OS: Windows95/98,
- 5    · DB connection software: ODBC driver for Oracle,
- communication network software: SQL-Net for Oracle,
  - work standard creation system application program,
  - standard manhour setting system application program, and
  - work assignment system application program.
- 10   On the other hand, the server-side computer has a system configuration comprised of
- OS: Windows-NT server, and
  - database: Oracle WorkGroup Server
- On the assembly standard information management system
- 15   constructed by a plurality of clients and one or a plurality of servers, three application programs or the "work standard creation system 2800", "standard manhour setting system 2801", and "work assignment system 2802" simultaneously or independently run in the so-called client/server
- 20   environment.

Current computer hardware capable of realizing the general client/server environment can be applied to each of the internal hardware configurations of the server and clients of the assembly standard information management system, and a detailed description thereof will be omitted in this embodiment.

<Work Standard Creation System 2800>

The work standard creation system 2800 defines/creates master data to be used by the standard manhour setting system 2801 and work assignment system 2802.

5       A "work standard" represents a certain work unit in the manufacturing process. One work process\_(to be referred to as a process hereinafter) is formed from a plurality of work standards (or one work standard in some cases). To manufacture products of a model, a plurality of processes  
10      are defined for the products of the model, and one or a plurality of work standards are defined for each process, as shown in Fig. 2.

Referring to Fig. 2, process 1, process 2,..., process N are defined for a representative model A. A plurality of  
15      "work standards" can be defined for each process. Each work standard is input through an input window (either from the client terminal or the server terminal) as shown in Fig. 3.

As will be described later, in this embodiment, the basic work unit is called a "work standard" that is the base  
20      of work in the assembly process. However, the "assembly standard information management system" of this embodiment is finally a system for managing assembly of products in the factory and therefore is preferably capable of management not at the work standard level but at the product level.

25       As will be described later, one work is assigned one identifier (or directory). Sets of a plurality of work

standards are classified using a hierarchical structure including "target model", "representative model" as the upper level thereof, and "genre" as the further upper level (e.g., a genre such as "printer" or "camera"). More

5 specifically, the CRT window (display window) of the terminal displays menus:

- "create" menu, and
- master maintenance

When the user selects the "create" menu in this display  
10 window, a dialog box for inputting the name of "representative model" and the name of "process" appears on the screen of the display unit. In this window, the user inputs the name of "representative model" and the name of "process". For example, assume that the input name of  
15 "representative model" is "BJC-4200", and the input name of "process" for the model "BJC-4200" is "total assembly". The application program will create a record "total assembly" under a record "BJC-4200" and create a plurality of work standard records under the record "total assembly".

20 The main menu of the application program includes "work standard", "edit", ..., and the pull-down menu of the "work standard" menu includes "file new (N)".

The input window shown in Fig. 3 is displayed when the "file new (N)" is selected. That is, this application  
25 program allows the user to define a certain work of the representative model "BJC-4200" through the input window

shown in Fig. 3. The user inputs the name of the work in a "work name" field 312.

In addition to the "work name" field 312, a window 300 shown in Fig. 3 has

- 5   · a field 302 to which the name of an "applied model" is to be input,
- an input field related to parts to be used in this "work" ("part number" field 303, "part name" field 304, and "quantity" field 305),
- 10   · an input field related to tools to be used in this "work" ("tool/treatment device/auxiliary material" field 306, "quantity" field 307, and "check etc." field 308),
- a field related to work standards as characteristic input items of this application program ("number" field 309, "work
- 15   standard" field 310, and "note" field 313), and
- a field 311 to which information related to a later revision/change of this "work" is input.

Fig. 4 shows files opened by this application program, which form a master data file group. Each master file will  
20 be described later.

Fig. 5 is a flow chart for explaining the input procedure for the input window shown in Fig. 3.

First, an input to the "applied model" field 302 is done in step S100 shown in Fig. 5.

25           The input in this step can be done in two ways: a direct input method by which the user directly inputs data to the

field using a keyboard, and a menu input method by which an icon 301 is clicked to display a window with the list of a plurality of candidate names of the "applied models", as shown in Fig. 6, the user selects one of the displayed 5 candidate names using a mouse or the like, and the selected name is input to the field 302. In the example shown in Fig. 7, the names of a plurality of "applied models" selected in the window shown in Fig. 6 are input to the field 302.

In step S200, the user inputs a desired note to the 10 note column through the keyboard.

In step S300, the user inputs data related to parts or tools to a predetermined field through the keyboard while moving the cursor to an arbitrary position in the field using the mouse.

15 A part number pairs with a part name. When one of them is input, a part data master file 40 (Fig. 4) is searched (so-called incremental search) using the input character sequence as a keyword, so all pairs of part numbers and part names having that keyword are displayed, as shown in Fig. 8. 20 The user selects a pair from the displayed candidates, so the selected pair data is output to a predetermined field.

The method of incremental search used for the above search will be described with reference to Figs. 9 and 10.

25 In the incremental search, search is executed using characters input until the current time as a keyword to display candidates searched at the current time, and every

time one more character is input, the candidates that have already been searched are narrowed down to only those matching the character sequence including the added character.

5        In the example shown in Fig. 9, when "GE" ("V") is input to an input field (upper field), various words and phrases starting with "V" are displayed in an output field (lower field) as candidates. Further, when "NZO" is input next to "V", words and phrases starting with "現像 (GENZOU: 10 developing)" are displayed in the output field as candidates, as shown in Fig. 10. That is, the candidates shown in Fig. 10 are narrowed down from those shown in Fig. 9. Note, that English translations corresponding to each of the Japanese candidates are described, for easy understanding, in 15 parentheses after the Japanese candidates in Figs. 9 and 10.

The description will be continued referring back to the flow chart shown in Fig. 5.

In step S400, pieces of information related to tools and the like are input to the fields 306, 307, and 308. For 20 this data input as well, the direct input using the keyboard and the method of searching from the master file (tool file 60) are prepared, like the input in step S300.

In step S500, the user inputs details of a work standard for the work to be defined. The data input for definition 25 of a work standard is the gist of the data input in the work standard creation system 2800, and a dedicated input window

as shown in Fig. 11 is prepared. Details of step S500 are included in the control procedure shown in Fig. 14.

When the user double-clicks on an arbitrary part of the "work standard" field 310, the input window shown in 5 Fig. 11 is displayed. When a work standard has already been input to the double-clicked position, i.e., when the user double-clicks on a portion where the name of an already input "work standard" is displayed, details of the already input work standard are displayed in the window shown in Fig. 11.

10 As shown in Fig. 11, one "work standard" comprises

- a "comment 1" field 1101,
- an "object" field 1102,
- a "comment 2" field 1103, and
- a "verb" field 1104.

15 "Operation" that defines one work is defined by the "verb" field 1104, and the target of the "operation" is defined by the "object" field 1102. The subject of the operation in the "verb" field 1104 is an operator. Hence, who is the operator need not be explicit.

20 "Comment 1" describes a comment about the "object".

"Comment 2" describes a comment about the "verb". For example, if

"comment 1" = "at wwww position",

"object" = "xxxx",

25 "comment 2" = "become yyyy",

"verb" = "do zzzz"

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are input, the user understands when the work standard is displayed that the operator should execute a work of "doing zzzz such that xxxx at www position becomes yyyy". Hence, appropriate and simple information must be input to the 5 fields 1101 to 1104 assuming the above understanding by the operator. In other words, standardization is impossible if \_ the user arbitrarily inputs data to the fields 1101 to 1104. To avoid this, the work standard creation system 2800 prepares in advance a standard database 70 already input in 10 relation to "comment 1", a standard database 80 already input in relation to "object", a standard database 90 already input in relation to "comment 2", and a standard database 100 already input in relation to "verb", as shown in Fig. 4. Additionally, when the user is going to input the respective 15 items related to the work standard, the above-described incremental search method for the master databases corresponding to items that the user will input allows the user to execute reference input of already input data. Hence, defined standard terms can be input to the fields 1101 to 20 1104 regardless of the user.

The reference input operation related to the work standard will be described here with reference to Fig. 11 and the like.

Referring to Fig. 11, a field 1105 is divided into a 25 reference instruction field 1105a and a work standard display field 1105b. "00\*" is always displayed in the reference

instruction field 1105a. The user who requires the reference input should double-click on the field 1105a.

An explanation will be done below by exemplifying a data input to the "comment 1" field 1101.

5 First, the user selects the field 1101 to notify the system that the user requires the data input of comment 1.

When the user double-clicks on "00\*" in the field 1105a, the fields 1101 to 1104 shown in Fig. 11 disappear, and instead, a field 1201 in which a keyword for search of a 10 reference item can be input and a field 1202 in which a plurality of reference item candidates are to be displayed are displayed, as shown in Fig. 12.

For example, as shown in Fig. 13, assume that the input to the "comment 1" field 1101, "object" field 1102, and 15 "comment 2" field 1103 is ended, and data "移動させる (IDOUSASERU: move)" is to be input to the "verb" field 1104 next. In this case, the user selects the "verb" field 1104 in the input window shown in Fig. 11 and double-clicks on "00\*" in the field 1105a. Then, the window changes to that 20 shown in Fig. 13.

The user does not know the standard verb for the operation "移動させる (IDOUSASERU: move)" but knows that at least the character "動 (DOU: move)" must be used. Referring to Fig. 13, the user inputs "動 (DOU: move)" to the field 1201. 25 The system searches the "verb" master database file 100 for all verb data having the character "動 (DOU: move)". In the

example shown in Fig. 13, verbs

"移動させる (IDOUSASERU: move)" ,

"往復動作させる (OUFUKUDOUSASASERU: reciprocally move) ,

and

5 "動かす (UGOKASU: move)

are stored in the database 100. These words are searched for the displayed in the field 1202. The user selects "移動させる (IDOUSASERU: move)" in the field 1201 through this window.

When "移動させる (IDOUSASERU: move)" is selected in the window

10 shown in Fig. 13, and then, the ENTER key of the keyboard is pressed, the window returns to the window shown in Fig. 11, where "移動させる (IDOUSASERU: move)" is displayed in the field 1104.

The reference input is used for the input to all the  
15 fields 1101 to 1104 (steps S506 to S512 in Fig. 14).

A plurality of work standards are displayed in the field 1105 except the field 1105a. Fig. 15 shows that four work standards (procedures 01 to 04) are input.

Each of the work standards can be assigned a note, as  
20 shown in Fig. 16.

A note is input to a field 1106. The reference input function can also be used for the input of a note. More specifically, when the user wants to add a note to the already defined work standard 01 (displayed in the field 1105b), the  
25 user selects the field 1105b using the mouse and then selects the field 1106 using the mouse. If the user individually

requires the reference input, the user double-clicks on "00\*" in the field 1105a. Then, a field 1107 changes to a keyword input field 1601 and reference item display field 1602, as shown in Fig. 16. For example, when the user wants to refer 5 to a note including a word "注意 (CHUI: note)", the user inputs "注意 (CHUI: note)" to the field 1601. The work standard creation system 2800 searches the note database 50 (Fig. 4) and displays all notes including "注意 (CHUI: note)" in the field 1602, as shown in Fig. 16. When the user selects a 10 desired note using the mouse and presses the ENTER key, the note is displayed in the field 1107, as shown in Fig. 17.

In this system, an input data editing function is prepared as processing in step S514 (Fig. 14).

In this editing function, to individually change a 15 character in data representing work contents, the number of the work standard to be changed is selected in the field 1107, and the work standard is double-clicked. Then, the data of "comment 1", "object", "comment 2", and "verb" assigned to the procedure are displayed in the fields 1101 to 1104, 20 respectively, and a note corresponding to the procedure is displayed in the field 1106. The user individually corrects the data in each field.

A method of editing one unit of the work standard will be described next with reference to Fig. 18. Editing each 25 unit of the work standard means an operation of deleting one work standard, an operation of setting the same work standard

to another sequential position, or an operation of setting (inserting) a "free" work standard between two arbitrary work standards adjacent to each other.

- A menu 1802 shown in Fig. 18 is opened, for example,  
5 when the right mouse button of the client is clicked.

In this menu 1802, editing functions including

- cut, copy, paste, add, delete, and
  - undo, revise (change), revise (delete)
- are set.

- 10 To "delete" a work standard, the target work standard is selected, and the "delete" menu is selected. To copy the contents of a work standard, the "copy" menu is selected. To paste work standard data copied in the work memory to a desired sequential position, the sequential position is  
15 selected, and the "paste" menu is selected. With this "paste" operation, the contents of the work standard at the paste position are popped down.

- To set a free work standard to the position of sequence 01, procedure 01 is selected in Fig. 18, and the "add" menu  
20 is selected. In the example shown in Fig. 18, work standards 01 to 03 sequentially move to procedure positions 02 to 04, and a free procedure is set to procedure position 01.

- These various editing functions for "work", which are prepared in the work standard creation system 2800, are  
25 commonly used as editing functions in the standard manhour setting system 2801 or work assignment system 2802 to be

described later. The mouse operation for these editing functions is also common. The operation is simplified by this common scheme.

A function of changing the order of a plurality of  
5 already input work standards will be described with reference  
to Figs. 18 to 20.

Assume that three procedures or works:

- 01: confirm 100V system
- 02: wind AV cord
- 10 · 03: set CRG holder

are currently set as work standards, as shown in Fig. 18, and the user wants to exchange procedure 01 with procedure 02. In this case, the user selects procedure 01 and selects the "cut" menu. With the series of operations, the contents  
15 of procedure 01 are saved in the work memory, and the contents of procedures 02 and 03 are sequentially shifted to procedures 01 and 02, as shown in Fig. 20. Next, the operator selects the procedure to be exchanged (procedure 02 in the example shown in Fig. 20) and selects the "paste" menu. As  
20 shown in Fig. 19, the contents of all procedures from procedure position 02 are sequentially popped down to the lower procedures, and simultaneously, the contents of original procedure 01, which are saved in the work memory, are pasted to procedure position 02.

25 With the above operation, the input or editing in steps S502 to S514 in Fig. 14 is ended. The user presses an OK

button 1108 to indicate that the input of work method is ended.

When the OK button 1108 is pressed, the window returns to the window shown in Fig. 3. In the window shown in Fig. 3, especially, the plurality of set work standards would be  
5 displayed in the field 310, and the note would be displayed in the field 313.

The user gives a "work name" as a standard work to the plurality of work standards set in the field 310. That is, the user inputs the work name to the field 312.

10 When setting of one standard work is ended, the user selects "save" in the menu shown in Fig. 21.

<Editing of Work Contents>... Work Standard Creation System  
2800

15 To edit work contents, "open" in the "work standard" menu is selected (Fig. 22), and the work standard to be edited is selected using the mouse (Fig. 23). When an OK icon 2301 is clicked, the selected work is displayed (e.g., as shown in Fig. 3). Editing is done through almost the same window as in the input.

20 <Input of Graphic Data>... Work Standard Creation System 2800

The assembly information management system can display a process set by the work assignment system 2802 at the site of work (client side). For example, when window display shown in Fig. 3 is done at the site of work, the operator  
25 can see the display and confirm the work contents, notes, tools, and parts at a glance. In this system, an image can

be attached to each work standard in addition to the above character information for the work.

Fig. 24 shows a window for inputting graphic data. This window is displayed when the user selects the 5 "illustration" menu (menu on the right side of the "edit" menu) in executing the application program of the work standard creation system 2800, and a graphic pattern displayed in accordance with the selection operation can be edited. The image file to be edited is created in advance 10 by a presentation application program PowerPoint (available from Microsoft) or Canvas and stored as a graphic file 120.

When the user selects the "display" submenu in the "illustration" menu, an illustration display column 2500 (Fig. 25) is displayed. The user inputs the name of a file 15 to be attached to a "file name" field 2501 in the display column 2500. In accordance with the input, the system searches for the file whose name is input to the "file name" field 2501 and displays it in the column 2500. In the example shown in Fig. 26, an image file "so-09.wmf" is displayed at 20 a position corresponding to the illustration display column 2500 shown in Fig. 25 as the result of user's file name input operation.

To edit the image, the authoring tool for editing is selected, and then, the "edit" menu is clicked, as shown in 25 Fig. 27. After the end of editing, the update result can be saved by clicking on an "update" icon 2602 (Fig. 26).

In the above example, the image is a still image in the BMP format. However, it may be a moving image compressed by MPEG.

A so-called animation image may be stored in the 5 graphic file 120 (Fig. 4). In this case, each animation image is stored with predetermined parameters unique to the operation of the image.

In assigning parameters unique to an operation to the operation in advance, if operations are, e.g., "screw", 10 "rotate", and "open", for example, pieces of parameter information:

- operation: screw → parameter values: direction of screwing, moving distance, torque amount, ...
  - operation: rotate → parameter values: direction of rotation, moving distance, ...
  - operation: open → parameter values: direction of opening, moving distance, weight, ...
- are registered.

An image with such parameters is registered in the 20 graphic file 120 by combining the directory name, operation (verb) name, and parameters for each animation image, as shown in Fig. 89.

When the graphic file 120 stored in the state as shown in Fig. 89 is present, and in this state, a work standard 25 is defined in the window shown in Fig. 11, the value of a parameter to be set for the work standard is written in the

"comment 1" or "comment 2" field in units of operations of the work standard. The system compares each operation with each of the verbs and the parameter value in the comment with each of the parameter values registered in the graphic file  
5 and assigns the directory of an animation image having matching operation and parameter to the work standard. The directory name of the assigned animation image is displayed in a field 2601.

Fig. 90 shows an example in which three work standards:  
10   · screw A.  
     · rotate main body, and  
     · open cover  
are defined for a product. In this example, two continuous still images (animation images) are assigned to each  
15 operation. In other words, when the parameters of the respective operations are assigned to the three work standards, a series of images  $A_1 \rightarrow A_2 \rightarrow B_1 \rightarrow B_2 \rightarrow C_1 \rightarrow C_2$  are continuously displayed, so a work instruction easy to understand can be easily created. In addition, only by  
20 designating an operation name and parameter, an animation image corresponding to the work parameter can be designated.

When an animation image is employed, no photorealistic image need be prepared, so work standard data can be created at the initial preparation stage before the start of  
25 operation of the factory. For creation of work standard data at the initial stage, automatic image data designation using

parameters is preferable.

<Translation>... Translation System

Assembly work is not always done only in Japan. This system for standardizing assembly work expects operation not only in Japan but also in many foreign factories (for example, factories in the English-speaking zone and Thai-speaking zone). For this purpose, the work standard creation system 2800 has a translation system 2803.

As shown in Fig. 28, the translation system 2803  
10 downloads master data created by the work standard creation system 2800 from the work standard creation system 2800, and after translation, uploads the translated master data to the work standard creation system 2800, as shown in Fig. 28.

The menu of the translation system 2803 includes  
15 "upload" for uploading work standard data to the master file, "work standard download" for downloading work standard data from the master file, and "work standard translation" for starting translation, as shown in Fig. 29. Icons for switching the translation target between work standard and  
20 master data are also prepared.

For example, when work standard data is selected as a translation target, a window 3000 as shown in Fig. 30 is displayed to prompt the user to input a "representative model name" (3001) and "process name" (3002).

25 With a check box 3003, display of the entire text, display of only an untranslated portion, or display of only

an error portion of translation is selected as the range of the display target. With a check box 3004, the translation language can be selected. When the user clicks on a "display" icon button 3007, the names of all works having the model name input to the "representative model name" field 3001 and the process name input to the "process name" field 3002 are displayed in a display area 3005.

If the user wants to translate all works in this display state, he/she clicks on a "select all" button 3006 to select all works. If the user wants to translate some works, he/she selects the names of works to be translated in the area 3005 using the mouse or the like and clicks on a "translate" button 3008. In accordance with clicking by the user, translation starts. When translation by the translation system 2803 is ended, "x" in the "auto-translation" column on the right side of the translated work name in the area 3005 changes to "○".

For work names (field 312 in Fig. 3), part names (field 304), tools and the like (field 306), and notes and the like (field 313) of text data registered in the master data file, the translation system 2803 converts the Japanese to the English using a dictionary. Since this is conversion from words to words, a dictionary (table) is preferably used. Especially, since this work standard creation system 2800 uses the incremental search in inputting data, standard terms are used, and arbitrary word selection is eliminated, as

described above. For this reason, the conversion accuracy improves.

However, the work procedure (field 310) is manually input by the user. This is because the language structure 5 of the Japanese is largely different from that of the English, and data (especially comment 1 and comment 2) constructing the work standard with high arbitrariness (i.e., close to a natural language) is unsuitable to conversion using a table.

10 To prevent a bulky system configuration, the translation system 2803 does not employ a translation method using language analysis (semantic analysis). A reason for this is as follows. In work management, many natural language texts are not always input. Translation is 15 necessary only on a limited occasion when a work is to be newly defined, or work contents are to be changed, so machine translation that is expensive and time-consuming for maintenance is inappropriate. Between European languages (e.g., English and German) having relatively similar 20 language structures, machine translation is appropriate even for the contents of work standards.

Another reason why the advanced machine translation is not employed between, e.g., Japanese and English is the problem of operating system. That is, there is currently no 25 operating system depending on two languages. For example, the WINDOWS of Japanese version and WINDOWS of English

version do not simultaneously run for the work standard creation system 2800.

In addition, currently, a work standard is created using one language (e.g., on the Japanese side), and only 5 software that runs on the WINDOWS (or WINDOWS NT) of Japanese version has the function of converting the Japanese text to English. In other words, converting various terms (text data) created by the work management system to the language of another country depends on the function of the language 10 of the operating system based on the official language of that country. For this reason, conversion using a table is most reliable for easy translation to the language of that country.

As described above, this translation system uses word 15 conversion using a table (table dictionary) for a word in a work standard. Additionally, if the table dictionary also stores a converted word for a phrase longer than a word, the phrase is replaced with the converted word. In principle, a word in a work standard, which cannot be completely 20 translated even using the table dictionary, is manually corrected.

To confirm the translation result for a work, the name of the work is selected in the display area 3005, and the "display" button 3007 is clicked. Then, a window as shown 25 in Fig. 31 is displayed. Whether the translation has been appropriate is determined by checking the translation result.

To verify the adaptability between a specific English word and a corresponding Japanese (adaptability of translation result), the word portion is double-clicked to display a correction window 3200 as shown in Fig. 32.

5 All work standards of the work with this work name are displayed in Japanese in an area 3202. English work standards corresponding to these Japanese work standards are displayed in an area 3204. In the example shown in Fig. 32, work standard 01 is selected. This selected work standard  
10 01 is displayed in Japanese in an area 3201, and an English equivalent of procedure 01 is displayed in an area 3203. The English text is corrected in the area 3202.

<Voice Input>... Translation System

Data input in the work standard creation system 2800  
15 and, more particularly, translation of work standards into the language of another country is done by word conversion and manual input. Manually inputting a translated text requires the user to have both an ability of translation and an ability of high-speed input using the keyboard. Since it  
20 may be difficult to ensure an operator who has both the abilities in that country, the translation operation and input operation are separated. That is, a translation result is recorded by voice input, and the data is input in playing back the recorded voice.

25 To input (record) voice, a work standard to which input voice is to be attached is selected, and the "new" menu in

the voice menu (Fig. 33) of the translation system application program is selected, thereby displaying a window shown in Fig. 34 overlapping the window shown in Fig. 31. When the recording button (●) in the window shown in Fig. 34 5 is clicked, recording starts. The voice sampling rate and the like are set in advance. To end recording, the ■ button is clicked. To save the recorded voice, "save" in the "work standard" menu is selected.

Fig. 35 shows the storage positions of files saved in 10 the work standard creation system 2800 and translation system 2803.

Both the work standard creation system 2800 and translation system 2803 can process not only voice and image files but also, e.g., MOVIE files by QUICKTIME.

15 In the work standard creation system 2800, a plurality of files temporarily registered, as shown in Fig. 35, can be reproduced together (including voice and images). For example, when one or a plurality of work standards are selected in the window shown in Fig. 23, and display in the 20 "illustration" menu or "playback" in the voice menu is selected, the images/voices of the work standards are displayed/played back in the defined order.

The voice and image are preferably synchronized. A 25 QUICKTIME file or MOVIE file can easily synchronize voice and image. The work standard creation system 2800 also proposes to superpose CG data of an arrow or the like on still

image data. During voice playback of a work, the arrow can visually indicate the operator in detail which work portion is being mentioned.

The work assignment system 2802 to be described later  
5 composes the work standard data created by the work standard creation system 2800, thereby assigning each work to a desired workshop. The result is reflected to a composition table file 6400 to be described later. The composition table file 6400 is uploaded to the work standard creation system  
10 2800.

More specifically, the work standard creation system 2800 can input works in the composition order corresponding to actual assembly workshops from the work assignment system 2802 and open the works. The uploaded file has voice data  
15 and image data attached by the work standard creation system 2800. When the voice/image playback function of the work standard creation system 2800 is exploited at the actual site of assembly, the work contents can be instructed to the operator in detail by voice and image.  
20

#### <Effect of Work Standard Creation System 2800>

According to the work standard creation system 2800 of the above-described embodiment, the following effects can be obtained.

AD-1: The work standard creation system 2800 describes  
25 a work related to a work standard by an operation phrase representing an operation of the work, an object phrase

representing the target of the operation, and a comment phrase representing auxiliary information related to the operation or object. Hence, all work standards are standardized by the elements including the operation, object,  
5 and comment phrases.

AD-2: The work standard creation system 2800 is preferably built under a client/server computer system. When a common memory (or disk) connected to the subsystems to store or read out work standards is prepared, a  
10 client/server distribution system for assembly information management is provided.

AD-3: In this embodiment, the translation system 2803 can translate the operation, object, and comment phrases in each record of the standard manhour database into a  
15 predetermined language such that the system can operate in a country with a different language.

AD-4: For translation by the translation system 2803, a translation method using matching to a dictionary is employed in consideration of easiness.  
20

AD-5: Image data or voice data can be attached to a work standard.

AD-6: Since not only a photorealistic image but also CG data or animation image can be used as image data, work standard data can be created at the initial stage quite before  
25 the actual operation of the factory.

<Standard Manhour Setting System 2801>

The standard manhour setting system 2801 is a system for determining the standard manhour of a desired work and is connected to the work standard creation system 2800. More specifically, as shown in Fig. 28, the standard manhour  
5 setting system 2801 and work standard creation system 2800 share master data and the like. Determination of the standard manhour by the standard manhour setting system 2801 is preferably done in the form of so-called batch processing. Hence, after master data including work standard data as the  
10 determination target is downloaded to the standard manhour setting system 2801, the standard manhour setting system 2801 determines the standard manhour.

The above-described work standard creation system 2800 does not input manhour data. The work standard creation  
15 system 2800 does not give a manhour value to a standard work because, in the standard work created by the work standard creation system 2800, the manhour value given to each work must not vary depending on the person or day. The idea is that the manhour value is determined by the user who will  
20 compose works at the time of composition. To standardize the manhour value, the standard manhour setting system 2801 uses standard data as basic manhour data.

As shown in Fig. 28 or 36, the standard manhour setting system 2801 outputs a manhour setting file 3601 using, as  
25 reference files, a standard data (to be referred to as CS (C. Standard data) hereinafter) file 2804 and operation

pattern data file 2806.

Fig. 37 shows the data structure of the manhour setting file 3601. The manhour setting file 3601 shown in Fig. 37 has records in units of element works and has the names of  
5 the element works, the frequencies of the element works, the manhours of the element works (unit: RU), the values of "CS", and the values of "set conditions". More specifically, the value of the directory of a data file containing the contents of a set condition given to the work is stored in the "set  
10 condition" field. The value of the root directory of the set condition data file is stored in the "CS" field.

Fig. 38 shows the data structure of the standard data file 2804. Each record of the standard data file 2804 is called a standard material. As shown in Fig. 38, each record  
15 of the standard data file 2804 has a "comment 1" field, "object" field, "comment 2" field, "verb" field, and "set condition" field. The "comment 1", "object", "comment 2", and "verb" fields in the standard data file 2804 are the same as those in the work standard creation system 2800. Set  
20 condition data will be described later.

Fig. 39 shows examples of the data structure in the standard data file 2804. Referring to Fig. 39, standard material data 3901 of an element work has directories "SPG3/T133/M11/0", and standard material data 3902 of  
25 another element work has directories "ASHD/T11222/T1111".

The operation pattern data file 2806 has the same data

structure as that of the CS data file 2804. More specifically, work data contained in the operation pattern data file 2806 include data as shown in Fig. 38, which are related to works actually executed in the past. Only the difference from the 5 standard data file 2804 is whether the work is recognized as a "standard".

As described with reference to Fig. 2, there are an infinite number of works related to manufacturing a device (printer) as a product. However, as described with reference 10 to Figs. 1 to 35, the work standard creation system 2800 can easily define a number of element works as "work standards" each constituted by

- two comments,
- object, and
- 15 · verb

Especially, as shown in Fig. 2, work standards are classified into processes, and processes are classified into models. In other words, models, processes, and works have tree structures, as shown in Fig. 2.

20 On the other hand, the work assignment system to be described later changes the composition of element works in consideration of the manhour. That is, the work standard creation system 2800 defines works, and the standard manhour setting system 2801 sets the manhour such that the composing 25 operation by the work assignment system 2802 is facilitated.

The work standard creation system 2800, standard

manhour setting system 2801, and work assignment system 2802 commonly have work elements with identifiers. However, since the identifiers themselves do not make the user remember the work contents, the master files cannot be  
5 searched using the identifiers of work elements (standard works). Hence, this system is designed to be able to execute multi-keyword searching using, as keywords, a total of four phrases, i.e., two comments, object, and verb common to all the systems.

10 To give a manhour to each work created by the work standard creation system 2800 in advance, the standard manhour setting system 2801 searches the standard material data file 2804 using the total of four phrases, i.e., two comments, object, and verb (the combination of these four  
15 keywords will be referred to as a "work identification multi-keyword" in this specification) and gives manhour data (the above-described "manhour" and "set condition") attached to the found standard data to each work data of data created by the work standard creation system 2800.

20 The outline of this procedure is shown as a flow chart "search of manhour standard material" on the left side of Fig. 40. Referring to this flow chart, work standard data created by the work standard creation system 2800 is loaded in step S4001. In step S4002, it is determined for each work  
25 whether data having work identification keywords matching (or partially matching or ambiguously matching) the work

identification multi-keyword of the work is present in the standard material data file 2804, and if so, manhour data HS of a record in the standard material data file is assigned to the work standard data. For example, work data loaded from  
5 the work standard creation system 2800 is represented by X, and a work identification multi-keyword of the data X is represented by KW. In step S4004, the user has a chance to confirm whether the assigned manhour data HS is appropriate.

On the other hand, it is determined in step S4002 that  
10 the work identification multi-keyword KW of the work data X is not present in the standard material data file 2804, a record having the work identification multi-keyword KW is searched for from the operation pattern data file 2806 in step S4010.

15 As described above, the operation pattern data file 2806 has the same data structure as that of the standard material data file 2804. The difference between the two files is that data in the operation pattern data file is not a standard but at least has manhour data set in the past.  
20 When such work data is present in the operation pattern data file 2806, manhour data HP set for the work data is assigned to the target work. In step S4014, the user is given a chance to confirm whether the manhour data HP is correct.

That is, in the flow chart "search of manhour standard  
25 material" on the left side of Fig. 40 and the flow chart "search of operation pattern" at the central portion of

Fig. 40, manhour data is automatically searched from standard material data or past data and assigned without intervention of the user. However, there must be works unsuitable to automatic assignment. The flow chart on the 5 right side of Fig. 40 explains a user's procedure of directly setting manhour data to a work unsuitable to automatic assignment by the user.

As is apparent from Fig. 36, the standard manhour setting system 2801 has three routes to set manhour data. 10 Referring to Fig. 40, the route using the standard material data file 2804 is called a "first route", the route using the operation pattern data file 2806 is called a "second route", and the route in which the user directly analyzes a work and assigns manhour data is called a "third route" 15 for the descriptive convenience.

The work or procedure in Fig. 40 will be described using a detailed example shown in Figs. 41 to 44. Fig. 41 is a view for explaining for explaining data load in step S4001 of Fig. 40. Fig. 42 is a view for explaining the 20 operation of the first route in detail. Fig. 43 is a view for explaining the operation of the second route. Fig. 44 is a view showing a detailed example of the final manhour setting file 3601 obtained by the operation in Figs. 41 and 42.

25 As for the operations shown in Fig. 40, the operation of the first, second, or third route is performed every time

a work data file is downloaded from the work standard creation system 2800, i.e., every record of the work data file.

However, Figs. 41 to 44 show the operations as if the operation of the first, second, or third route were performed

- 5 at once for all the downloaded files, for the illustrative convenience.

Referring to Fig. 41, the manhour setting file 3601 before data load has the data structure shown in Fig. 37.

When data created by the work standard creation system 2800

- 10 is loaded to the manhour setting file 3601, the "comment 1" field, "object" field, "comment 2" field, and "verb" field in the work data file are loaded as an "element work name". Since the work data file does not contain manhour data, the manhour setting file 3601 has no manhour data at the stage  
15 of data load in Fig. 41.

For the descriptive convenience, the Japanese texts in the "element work name" field of the manhour setting file

3601 shown in Fig. 41 are not translated to English, and

English equivalents of these texts are indicated by \*1 to

20 \*5 in the margin of Fig. 41. This aims at indicating that when data in the respective columns of the table shown on the lower side of Fig. 41, which are created by the work standard creation system 2800, are directly loaded in this order, and the data in the row direction (horizontal

25 direction) of the columns are connected, these data form significant Japanese texts in that word order in the "element

work name" field.

Although each "element work name" shown in Fig. 42 and the like is illustrated as a series of text data for the illustrative convenience, the "element work name" field is  
5 actually separated into the "comment 1" field, "object" field,  
"comment 2" field, and "verb" field.

Fig. 42 explains the first route. For example, when the first record is downloaded from the work standard creation system 2800, standard data having the keyword KW  
10 "set load spring in treatment device for attaching load spring" is searched from the standard material data file 2804.

The symbol "\*" in the keyword formula shown in Fig. 42 and the like will be described here.

15 The "\*" is a symbol representing a wild card and can have an arbitrary value. Data shown in the first record of the standard material data file 2804 shown in Fig. 42 are  
· comment 1 = \*  
· object = \*"バネを (BANEO: spring)"  
20 · comment 2 = \*"に (NI: to)"  
· verb = "組み込む (KUMIKOMU: set)"

That is, since the "comment 1" field of the first record is designated to "\*", it matches any text data contained in the "comment 1" field of the "element work name" field as  
25 the work data in the manhour setting file. In a similar manner, for the "object", any word including "バネを (BANEO:

spring)" can match in all records. For the "comment 2", any word including "に (NI: to)" can match in all records. For the "verb", any word including "組み込む (KUMIKOMU: set)" can match in all records.

5        In the example shown in Fig. 42, the first record in the manhour setting file 3601 matches the first record in the standard material data file 2804, which has

"\*, \*バネを (BANEO: spring), \*に (NI: to), 組み込む (KUMIKOMU: set)", and

10      the second record having

"\*, \*を (O), \*に (NI: to), 組み込む (KUMIKOMU: set)"

In the standard manhour setting system 2801, when a record matches two or more records, it is determined that the record matches a record having the highest degree of matching. The degree of matching is obtained with reference to the number of characters except the wild card. In the example shown in Fig. 42, the first record in the standard material data file 2804 contains more matching text data than the second record. Hence, it is determined that the degree of matching is higher for the first record in the standard material data file 2804 than for the second record. It is finally determined that the record matches not the second record but the first record.

The first record in the standard material data file 2804 has a time value "41 RU" as a manhour, so "41" is set in the "manhour" field of the first record of the manhour

TOP SECRET//COMINT

setting file 3601. In addition, the first record in the standard material data file 2804 has ""SPG3/T133/M11/0" as "manhour standard material" data. The root directory of manhour information is "SPG3", and the sub-directories are  
5 "T133/M11/0". Hence, "SPG3" is stored in the "CS" field of the first record in the manhour setting file 3601, and data "T133/M11/0" is stored in the "set condition" field.

When this system is used in a non-Japanese-speaking zone, the "degree of matching" is determined with reference  
10 to the number of matching words.

For the above search in the standard manhour setting system 2801, perfect matching or partial matching by words or phrases except the wild card symbol are employed, and one candidate is always employed in principle. However, a  
15 plurality of candidates may be displayed in descending order of degrees of matching, and the user may finally select a candidate.

When similar checking is performed for the remaining four records in the manhour setting file 3601, the second  
20 record matches no record in the standard material data file 2804, the third records matches the second record in the standard material data file 2804, the fourth record matches no record in the standard material data file 2804, and the fifth record matches the third record in the standard  
25 material data file 2804.

Hence, for the third work data in the manhour setting

file 3601, which matches a record, "37" is assigned as a "manhour", "ASHD" is assigned as a "CS", and "T11222/T1111" is assigned as a "set condition". For the fifth work data, "16" is assigned as a "manhour", "PUMB" is assigned as a "CS", 5 and "T2111/T111111" is assigned as a "set condition". Thus, the manhour setting file 3601 is tentatively created as shown in Fig. 42 in accordance with the manhour data setting procedure by the first route.

On the other hand, for the second and fourth work data 10 that do not match any record by the first route, the procedure of the second route is executed as shown in Fig. 43. The text data of "element work names" of the second and fourth work data and the "comment 1", "object", "comment 2", and "verb" in the operation pattern data file 2806 are searched.

15 In the example shown in Fig. 43, the second and fourth work data match the first and second records in the operation pattern data file 2806, respectively. Hence, the values (" /GET-50E/M-10E" and " /GET-50E/M-10E") of the "operation pattern" fields of the first and second records in the 20 operation pattern data file 2806 are stored in the "set condition" fields of the second and fourth records in the setting file 3601. In this case, the records do not match the standard material data file, no value is written in the "CS" fields in the setting file 3601. Thus, the operation 25 of the second route is ended.

In this way, the manhour setting file 3601 is set as

shown in Fig. 44 by the operations of the first and second routes.

The operation of the third route is performed when the standard manhour can be determined by neither the first route  
5 nor the second route. In the third route, the standard manhour is determined by directly analyzing the WF (Work Factor).

The overall operation of the standard manhour setting system 2801 has been described above. Details of the  
10 operation of the standard manhour setting system 2801 will be described below.

#### <Data Load>... Standard Manhour Setting System

Fig. 45 shows the initial menu window displayed when the standard manhour setting system 2801 is activated. In  
15 this menu, six main menus:

- data load (icon 4501),
- standard manhour processing (icon 4502),
- standard material creation (icon 4503),
- master data maintenance,
- 20 · environment setup, and
- analysis material editing (icon 4504)

can be selected.

Data load is necessary before determination of the standard manhour. When the user selects the data load menu  
25 4501, a window as shown in Fig. 46 is displayed.

Referring to Fig. 46, the window is roughly divided

into two areas. A field 4601 on the left side indicates product symbols created by the work standard creation system 2800, i.e., product numbers (or the names of "representative models") that can be downloaded to the manhour determination  
5 system.

Fields 4602 to 4605 on the right side indicate work names downloaded from the work standard creation system 2800 in the past. More specifically, the field 4602 indicates the names of "work standards" downloaded by the standard manhour  
10 setting system 2801, the field 4603 indicates the "product symbols" of the respective "work standards", the field 6404 indicates the "names" of the respective "work standards", and the field 4605 indicates download dates, i.e., "load dates".

15 One or a plurality of "product numbers" to be loaded (downloaded) are selected from the field 4601 using the mouse. To give a name different from that set by the work standard creation system 2800 to the product to be downloaded, the product number of the product to be named is designated in  
20 the field 4601, and the "name" is input to a field 4601. Data load is started by selecting the product to be loaded with the mouse, clicking on a "select" button 4611, and clicking on an "OK" icon 4612.

When the user clicks on the "OK" icon 4612, work name  
25 data is loaded to the memory of the standard manhour setting system 2801, and a window as shown in Fig. 47 is displayed.

The window shown in Fig. 47 displays the list of works present on the memory of the standard manhour setting system 2801. A work downloaded previously can be discriminated from the current download data by referring to a previous load 5 date field 4703.

Since the standard manhour setting system 2801 is - separated from the work standard creation system 2800, works or work groups to be considered by the standard manhour setting system 2801 itself are present independently of works 10 or work groups set by the work standard creation system 2800. In the standard manhour setting system 2801, one work (or work group) is independently recomposed by the standard manhour setting system 2801 as another "component".

The component newly set by the standard manhour setting 15 system 2801 is discriminated from other components by a "component symbol". To create a component, the names of a plurality of works to be set in the component are selected in a field 4701, the "component symbol set" menu in the edit menu is selected, and a component symbol (field 9101) and 20 name (field 9102) are input through a window as shown in Fig. 91. Thus, the component symbol is assigned to a field 4702 in Fig. 47 in correspondence with the selected work names.

Referring to Fig. 47, a flag 4705a represents the state 25 of work standard data. When the value of this flag is "N", it represents that the work standard is newly created. When

the value is "C", it represents that the work standard is previously loaded to the standard manhour setting system 2801 and then changed on the standard manhour setting system 2801 side. When the value is "D", it represents that the work  
5 standard is previously loaded to the standard manhour setting system 2801 and then deleted on the standard manhour setting system 2801 side.

A field 4705b has a flag representing the approval state of a work standard. When the value is "F", it  
10 represents that the approver of the work standard is registered.

A field 4706 represents a number assigned to the work standard by the work standard creation system 2800. A field 4707 represents a number given to the work standard by the  
15 standard manhour setting system 2801.

Data is loaded in units of components. When the user selects the "execute" menu in Fig. 47, a "data load" window 4800 shown in Fig. 48 is displayed. The user designates the component symbol of a load target through a dialog 4801 in  
20 the window 4800.

More specifically, to load the component symbols of all components displayed, the user checks the "all" button. To designate and load a specific component symbol, the user checks the "designate component" button and inputs the  
25 component symbol name to a field 4802. As described above, for one component, a work name selected in the field 4701

in Fig. 47 with the mouse is recognized as one "component".

As shown in Fig. 49, in the standard manhour setting system 2801, a plurality of components can be defined. A single work can belong to different "components".

5       The advantage of providing "components" on the upper side of works is as follows. Since individual works themselves have high universality, they can hardly be strongly connected to a specific product. However, to re-define works in setting the manhour, or to re-define works  
10      in composing works in the workshop in consideration of the manhour, it is preferable for the user to connect the works to a name easy to remember the product to be manufactured, i.e., the name of the upper level.

Referring back to Fig. 48, the window 4800 also has  
15      a dialog 4803 in which a material to be referred to in automatically setting the manhour. That is, after the data load, whether an operation of automatically setting the manhour for the loaded work should be performed can be designated by a "standard material (CS) check button 4804 and "analysis material" check button 4805. The "standard material (CS)" is the standard material data file 2804, and automatic manhour setting by checking the "standard material (CS)" is manhour data setting by the above-described first route.  
20

25       The "analysis material" is the operation pattern data file 2806, and automatic manhour setting by checking the

"analysis material" is manhour data setting by the above-described second route. If the user does not want automatic manhour setting, both of the "standard material (CS)" and "analysis material" check buttons are turned off.

- 5 When the user clicks on an OK button 4806, the data load is started.

Fig. 50 shows the file structure of the standard manhour setting system 2801. As described above in relation to Fig. 36, the standard manhour setting system 2801 creates  
10 the manhour setting file 3601 on the basis of files loaded from the standard material data file 2804 and operation pattern data file 2806.

Referring to Fig. 50, the standard material data file 2804 and analysis material "operation pattern" data file 2806  
15 are created by a standard material creation routine 5001 and analysis material creation routine 5002, respectively, in advance.

In the above way, more specifically, in accordance with the control procedure shown in Fig. 40 (this control  
20 procedure is included in a standard material manhour processing routine 5003), manhour data is automatically set for work data downloaded from the work standard creation system 2800.

As shown in Fig. 49, the respective "works" (the  
25 "works" are not the sets of a plurality of detailed works but simple root directories) required to assembly a product

are linked by directories through one or a plurality of components (the components may be divided into a plurality of layers). In other words, when the directories are traced, the "product" assembly work can finally reach a work, and

5 which manhour data is set for the work can be confirmed.

- The program procedure of displaying work contents for this confirmation is included in the standard material manhour processing routine 5003. The manhour data automatically set by the standard material creation routine

10 5001 or analysis material creation routine 5002 can also be confirmed by the standard material manhour processing routine 5003. The standard material manhour processing routine 5003 will be described.

<Standard Manhour Processing>... Standard Manhour Setting  
15 System

Standard manhour processing is executed by clicking the "standard manhour processing" icon 4502 (Fig. 45). Individual "element works" correspond to work data and have a structure as shown in Fig. 38, as described above.

20 The standard material manhour processing routine 5003 is executed in accordance with the control procedure of the flow chart shown in Fig. 51. For the control procedure shown in Fig. 51, the directories are linked using a hierarchical structure

25 Product → component → model → work

In step S600, the "product" as a manhour setting target

THEORY OF THE INVENTION

is selected. Fig. 52 shows the product selection window. The target "product" is selected with the mouse or the like, and a "set manhour" button 5201 is clicked. When this button is clicked, the flow advances to step S602 to select a 5 "component". Fig. 53 shows the "component" selection window. A target component is selected with the mouse or the like, and a "next" button 5301 is clicked. When this button is clicked, the flow advances to step S604 to select a "model". Fig. 54 shows the "model" selection window. At this stage, 10 in the example shown in Fig. 54, since the user has selected the "product" and "component", "BJ-970909" and "97-09-09 load" are displayed as a product symbol and product name, respectively. In addition, "CH" is displayed as a component symbol.

15 Next, the target "model" is selected with the mouse or the like ("BJC-4300" is selected in the example shown in Fig. 54), and a "next" button 5401 is clicked. When this button is clicked, the flow advances to step S606 to select a "work" to be edited.

20 Fig. 55 shows the dialog for causing the user to select a "work" to be edited. At this stage, in the example shown in Fig. 55, since the user has selected the "product" and "component", "BJ-970909" and "97-09-09 load" are displayed as a product symbol and product name, respectively. In 25 addition, since "CH" is displayed as a component symbol, and "BJC-4300" is selected as the "model", "BJC-4300" and

"xxxxxxxx" are displayed as a set model symbol and model name, respectively.

Referring to Fig. 55, a plurality of works are displayed. In a field 5501, the "formal management No" of each work is set. In a field 5502, the "name" of each work is set. In a field 5503, the manhour value set for each work is set.

A field 5504 ("USE" field) stores the directory (corresponding to "set condition field" in the example shown in Fig. 43) of manhour set on the basis of automatic manhour setting by the second route, i.e., the operation pattern data file 2806 (this file is created on the basis of works used in the past). A field 5505 ("CS" field) stores the root directory (corresponding to "CS field" in the example shown in Fig. 42) of manhour set on the basis of automatic manhour setting by the first route, i.e., the standard material (CS) data file 2804.

At the stage in Fig. 55, the user can confirm manhour data (manhour value and manhour set condition (USE and CS)) automatically set. That is, in the manhour confirmation processes in step S4004 and S4014 of Fig. 40 are executed by the user through the display shown in Fig. 55. More specifically, in the example shown in Fig. 55, when a work has a value "0" as the "manhour" in the field 5503, it means that no corresponding work is registered in either the standard material data file 2804 or operation pattern data

file 2806.

In step S4004, when the manhour in the window shown in Fig. 55 is "0", to automatically set the manhour by the second route, the user returns to the window shown in Fig. 48  
5 to turn on the check box 4805 and click the OK button 4806.

After the end of automatic manhour setting by the second route, the window shown in Fig. 55 is displayed again, and it is confirmed whether a work having a "manhour" value "0" is present. If a work having a manhour value "0" is  
10 present, processing from step S608 in Fig. 51 is executed. Operations in step S608 and S610 correspond to step S4020 and S4022 in Fig. 40 (third route).

Step S608 in Fig. 51 is executed when the user clicks a "change" button 5506 to change the contents of the elements  
15 (comments, object, and verb) of a work or set the manhour value.

Fig. 56 shows a user interface window for editing a work element. To change a work element, the comment 1, object, comment 1, and verb are corrected in fields 5601 to 5605.  
20 To reflect the correction to the setting file 3601, the button 5605 is clicked. To edit the next work element, a button 5606 is clicked.

To edit element works in units of genres, a user interface window shown in Fig. 57 is displayed.  
25 <Operation Analysis>

As described above, when the manhour can be determined

neither by the first route nor by the second route, the  
contents of each work are analyzed to determine the manhour  
using the third route. The control procedure shown in the  
flow chart of Fig. 51 is used for operation analysis in the  
5 third route.

- To analyze a unit work, the user double-clicks on the  
name of a work to be analyzed in the window shown in Fig. 56.  
Then, step S610 is executed, and a user interface window shown  
in Fig. 58 is displayed.

10 In the user interface window shown in Fig. 58, the user  
inputs a target operation content to a field 5801 and a WF  
(Work Factor symbol) to a field 5802. A field 5803 stores  
the directory of a set condition.

In the example shown in Fig. 58, the operation of a  
15 work

"set main body to predetermined position"  
is analyzed, and the manhour is calculated. The analysis  
contents and set conditions obtained by analysis are stored  
in the set condition field 5803 as a directory including the  
20 data.

More specifically, for the analysis operation, a WF  
must be set for a work "set main body to a predetermined  
position". To do this, the field 5802 is double-clicked.

The WF is a known Work Factor symbol. In the standard  
25 manhour setting system 2801 of this embodiment, a  
characteristic user interface window as shown in Fig. 59 is

prepared to input the WF. In this embodiment, 17 WFs are prepared, as shown in Fig. 59. Since the user understands the operation content "set main body to predetermined position", he/she knows that this operation corresponds to 5 "pickup" (WF = PU). Hence, the user would check a first button (PU) 5901 and click a "select" button 5902.

In accordance with selection of a button corresponding to a WF in Fig. 59, a user interface window shown in Fig. 60 or 61 is displayed. Of the 17 WFs shown in Fig. 59,

10 PU, GET, ASY, MA, DSY, R, and Ri  
are WFs to be classified into a "table" type and can be set in the user interface window as shown in Fig. 60. In addition,

UMAC, MP, BODY, SUSD, TURN, STEP, and UMAN  
15 are WFs to be classified into a "formula" type and can be analyzed in the user interface window as shown in Fig. 61. Furthermore,

M, TD, and WALK  
are WFs to be classified into a "table/formula" type and can  
20 be analyzed in the above-described user interface windows as shown in Figs. 60 and 61.

The analysis setting user interface window for a table-type WF will be described with reference to Fig. 60 while exemplifying "pickup" (= PU).

25 Each operation is analyzed by a condition related to the operation and a threshold value used to determine whether

the condition is satisfied. For the "pickup" operation of the example shown in Fig. 60, five (six at maximum in accordance with the display window size) conditions, "moving distance", "grip type", "pre-positioning", "main size", and 5 "weight", are preset.

Six threshold values can be set for condition determination in accordance with the limited display window.

In the example shown in Fig. 60, threshold values "-10 cm", "+10 cm", and ">5 cm" are prepared for "moving distance".

10 Condition values are also preset for the remaining conditions, i.e., "grip type", "pre-positioning", "main size", and "weight". These condition and condition values (threshold values) are displayed when a "default value" button is clicked. For each condition, the user selects a condition 15 value that is suggested to be most appropriate. In the example shown in Fig. 60, the user selects

"+10 cm" for "moving distance",

"Qr-3" for "grip type",

"NO" for "pre-positioning",

20 "-10 mm" for "main size", and

"<3 kg" for "weight"

On the basis of the selection, the user would click on a "select" button 6001.

For the operation "set main body to predetermined 25 position", which is to be analyzed by the user, since the user himself/herself selects "PU", the system side knows that

the WF is of the table type, and analysis by a formula is unnecessary. Hence, to indicate that the user cannot operate, the icon of a "formula" button 6003 is displayed in a light color.

5        When the user clicks on the "set" button 6001, the system calculates the manhour (time) for each condition. For example, for the condition value "+10 cm" for the condition "moving distance", the moving speed of the worker is known, and time t1 required for movement by 10 cm is set for the  
10      condition "moving distance". In a similar way, for the remaining conditions "grip type", "pre-positioning", "main size", and "weight" as well, manhour times t2, t3, t4, and t5 are calculated, respectively, and the sum of times t1 to t5 is stored in a field 5804 as a manhour. In addition, a  
15      directory for storing the conditions and contents of condition values set in Fig. 60 is stored and displayed in the set condition field 5802 shown in Fig. 58.

Fig. 61 shows analysis definition for a formula-type WF using an example "TURN" ("change direction of body"). More  
20      specifically, when time (i.e., unit time) necessary for one cycle of the operation "change direction of body" is "10", a manhour for the operation "change direction of body" is generally represented by

$$10*m$$

25      where m is a variable representing the "number of times of operation of changing direction". In this system, a manhour

formula "10\*m" is set for TURN ("change direction of body") as a default value. Hence, referring to Fig. 61, the formula "10\*m" is displayed in a field 6101, the variable name "the number of times of operation of changing direction" is  
5 displayed in a field 6102, and the unit of the variable, "times", is displayed in a field 6104. The user inputs the value of "times m" in a field 6103.

On the basis of the selection, when the user clicks on a "set" button 6105, the manhour value is calculated,  
10 displayed in the manhour field 5804 in Fig. 58, and stored in the memory.

The work procedures of work analysis and manhour determination according to the third route have been described above.

15 <Log of Change in Manhour>... Standard Manhour Setting System

Starting from the dialog shown in Fig. 55, when the manhour set condition is changed, and the "change" button 5506 is clicked, the manhour value may change. The standard manhour setting system 2801 monitors whether the manhour  
20 value changes using click on the "change" button 5508 as a trigger.

When a change in manhour is detected, a user interface window shown in Fig. 62 is displayed to allow the user to input the change reason for the manhour. In the example shown  
25 in Fig. 62, a field 6201 contains "10" and indicates that the manhour change amount is "10". A field 6202 has a USE

value "0" and indicates that the work data is still unused. The change reason for the manhour is input to a field 6204. In the example shown in Fig. 62, the change reason is "new setting" because a work is newly registered.

5       The reason code in a field 6203 is provided in a one-to-one correspondence with the change reason. When a new change reason occurs for a work, a reason code with an arbitrary code can be assigned to the change reason. However, to ensure integrity in the entire system, the reason code  
10      to be set is preferably determined in advance.

To display reasons for change in previous setting in the field 6204 in scroll, the user clicks on a button 6206.

The change reason code set in the user interface window shown in Fig. 62 is displayed together with various kinds  
15      of information set for the work. For example, in the display window shown in Fig. 55, the reason code is displayed in a "correction" field 5507 (value "1").

This standard manhour setting system 2801 can hold the log of five changes (five or more if the memory allows) for  
20      one work. To confirm the log of change reasons, the column of the "correction" field 5507 of the work is double-clicked. Upon clicking, a change log correction window shown in Fig. 63 is displayed. The change reason is displayed in a field 6301, and preceding and succeeding manhour values are  
25      displayed in a field 6302. In the example shown in Fig. 63, the work "electrical check" has only one change reason.

However, when a plurality of change reasons are present, five change reasons are displayed at maximum while being stacked on the lower side.

<Work Assignment System>

5        As shown in Fig. 28, the work standard creation system 2800 creates work standard data containing no manhour data, and the standard manhour setting system 2801 creates the manhour setting file 3601 from the work standard data.

10      As shown in Fig. 64, the work assignment system 2802 downloads (loads data) the contents of the manhour setting file 3601 and creates a composition table file 6400. The work assignment system 2802 also determines the range of composition in the loaded manhour setting data, composes works within that range in accordance with a predetermined purpose, corrects the composition, and outputs the composition. In other words, it may safely be said that the work standard creation system 2800 and standard manhour setting system 2801 exist such that the work assignment system 2802 can

- 20      · automatically execute composition,  
· allow the user to easily grasp the composition result,  
· easily correct the composition contents, and  
· do composition matching the set purpose.

Fig. 65 illustrates inputs to the work assignment system 2802 and outputs from the work assignment system 2802.

Referring to Fig. 65, the work assignment system 2802

receives the range to be composed as range data 6502. Work data downloaded in accordance with this range is used for the composing operation. Also, division condition data 6503 for division to stations is input as a condition for  
5 composition.

Composition here means that a plurality of works in an order defined by the work standard creation system 2800 are distributed to a plurality of "stations" in accordance with the order of works (including a case wherein the order  
10 is changed by the work assignment system 2802).

A station means a physical station or simply indicates a plurality of work groups put together in terms of concept. Each station is assigned a specific operator. In this assignment, the work assignment system 2802 assigns a  
15 specific operator on the basis of the information of each operator (experience time or the degree of skill for a work), which is stored in an operator database 6501.

The work assignment system 2802 outputs a simple division window display output 6504 or window display output  
20 6505 (considering the parallel operation of works) to the display unit such that the user can easily confirm the composition result. The composition data can also be output in the EXCEL format as an example of a general document data format.

25 The work assignment system 2802 provides two division methods as composition methods. As one method, works are

simply divided to stations. As the other method, works are divided to stations in consideration of the parallel operation of the works (to be referred to as "parallel division" hereinafter for the descriptive convenience).

- 5 For either division method, work data download from the standard manhour setting system 2801 to the work assignment system 2802 is necessary.

Fig. 67 shows an example in which some works related to the assembly work of a model "GP55" are loaded to the work assignment system 2802 and displayed on the screen of the display unit. Referring to Fig. 67, "standard No" represents the work order defined by the work standard creation system 2800 and edited or corrected by the standard manhour setting system 2801. In other words, the work assignment system 2802 initially recognizes the order of work data in the manhour setting file 3601 of the standard manhour setting system 2801 as the work order in the work assignment system 2802. For data in the range of the loaded data (or the range designated by the work assignment system 2802), simple division or parallel division is executed.

- In the example shown in Fig. 67, the assembly work of one unit of model "GP55" comprises seven (or more) works
- NO. 1: stick handy cut tape
  - NO. 2: set labels on main body
  - 25 · NO. 3: Weiman removal
  - NO. 4: assemble outer case

- NO. 5: fit top pad
- NO. 6: stick large-side order label

The manhour of these works is

$$134 + 550 + 270 + 365 + 268 + 117 = 1704 \text{ RU}$$

- 5 In this case, 1 RU is 1/1000 min.

<Simple Division>... Work Assignment System

Generally, letting WF (unit: RU) be the total manhour in the composition, U be the number of units (the number of products) to be produced by one crew as a set of a plurality of operators per day, H (unit: RU) be the operation time of one crew (a set of a plurality of operators) per day, and E be the target composition efficiency (i.e., expected composition efficiency), the number of stations  $N_{st}$  to be divided is given by

$$15 \quad N_{st} = (U \times WF) / (H \times E) \quad \dots (1)$$

That is, when  $N_{st}$  stations are prepared, the above object can be achieved. In this setting, the time (i.e., pitch time  $T_p$ ) required for work in each station is given by

$$T_p = H/U \quad \dots (2)$$

20 In other words, the total manhour of works assigned to one station by simple division is assigned such that it almost matches the pitch time  $T_p$  in average. In the example shown in Fig. 66,

$$t_1, t_2, \dots, t_{n-1}, t_n \doteq T_p \quad \dots (3)$$

25 Fig. 68 shows a display window in which the works shown in Fig. 67 are divided to plurality of stations, and the work

contents of station 1 (St1) and station 2 (St2) are displayed. More specifically, of the seven or more works shown in Fig. 67, works Nos. 1 to 3 are assigned to station 1 (St1) and works Nos. 4 to 6 are assigned to station 2 (St2). In the example 5 shown in Fig. 68, the total manhour in station 1 (St1) is 954 RU, and that in station 2 (St2) is 750 RU. The total manhours "945 RU" and "750 RU" should fall within the pitch time  $T_p$ .

However, in an actual production workshop, composition 10 based on the theory may lower the efficiency. As a measure against this, the work assignment system 2802 prepares a means for easily correcting/changing the contents of composition. The correction/change means is shown in Fig. 69.

15 Fig. 69 shows a user interface window as the correction/change means displayed on the display screen of the display unit of the work assignment system 2802. More specifically, a bar graph 6901 represents the manhours (RU) assigned to the stations as a result of simple division. 20 Reference numerals 6902 and 6903 denote contents of works assigned to the respective stations, which correspond to the graph 6901.

Referring to Fig. 69, the bar representing the manhour of the station St1 matches the pitch time  $T_p$ , the bars for 25 the stations St2 and St3 are shorter than the pitch time  $T_p$ , and the bar for a station St4 exceeds the pitch time  $T_p$ .

A certain user may average the variation in manhour between the stations by exchanging the works between the stations. In addition, a certain user may empirically know that the efficiency can be improved by moving a specific work 5 to another station although it increases the variation in manhour.

To cope with this, in the work assignment system 2802, a work in the station St1 and a work in the station St2 shown in the table 6902 can be exchanged. When exchange is actually 10 done, the variation result of the total manhour in each station in accordance with the exchange is reflected to the bar graph 6901. In other words, the process change result can be visually confirmed on the bar graph.

For correction or editing in the work assignment system 15 2802, not only exchange of two works between different stations but also a change in work order in a single station, integration editing for integrating two works to one work, and editing for dividing one work into two works are prepared.

#### <Parallel Division>... Work Assignment System

20 In the simple division, works are divided to a plurality of stations simply in accordance with the work order defined by the work standard creation system 2800 or standard manhour setting system 2801. This simple division does not consider that there are some works that can be 25 operated in parallel. Parallel division is division that takes the parallel operation of works into consideration.

Fig. 70 shows a user interface window for defining the parallel operability of works. For the descriptive convenience, the example shown in Fig. 70 assumes an assembly procedure for a total of 14 works with numbers S (start) to 5 13. Assume that the names, process number, and manhours of all works as shown in Fig. 67 are displayed on the display screen of the display unit for user confirmation.

The user defines the parallel operation of works, which is known based on the experience of himself/herself, using 10 work icons and link lines for connecting the work icons, as shown in Fig. 70, while confirming the order of works on the table as shown in Fig. 67. In the example shown in Fig. 70, a work icon is symbolized by a circle and a work number in the circle.

15 In the example shown in Fig. 70, for example, since works 1, 11, and 3 are linked to work S and have no priority therebetween. Since work 4 linked to start work S must be executed subsequently after work 3 linked to start work S, work 4 cannot be handled equivalently to works 1, 3, and 11.

20 Even when the order of works 1, 3, and 11 which are parallel to each other and have no priority therebetween is changed, no problem is posed. This means that when parallel operation is taken into consideration, a plurality of composition plans are available. The work assignment system 25 2802 proposes composition plan 1, composition plan 2, ... and displays them, as shown in Fig. 71.

In this system, to present a plurality of composition plans, a parallel work "group" designation function as shown in Figs. 92 and 93 is set.

- Group designation of works means that the same group code is given to a plurality of works to assign them to a single station. The group designation function is provided to designate works requiring the same tools to the same group or works using components on a single attachment surface to the same group to suppress the purchase cost for expensive tools, or designate works to the same group in order to put assembly works together to effectively use the machine manhour time for other works such that works having the same group code are prevented from being assigned to different stations.
- Conventionally, the priority of assignment based on such a condition is processed by logic (rule or the like). However, since designating works using the same tools to the same group may be inconsistent to designating works using components on a single attachment surface to the same group, unique determination may result in an assignment error. In this system, a person experienced in work assignment can manually give a group code to works to be assigned to a single station before execution of automatic composition.
- However, group designation that impedes assignment based on the priority table is not allowed, as shown in Fig. 94.

As shown in Fig. 92, when works 2 and 3 are designated to a group, works 2 and 3 are assigned to a single station (composition plan 1 in Fig. 71).

On the other hand, as shown in Fig. 93, when works 5 and 8 are designated to a group, works 2 and 8 are assigned to a single station (composition plan 2 in Fig. 71).

As shown in Fig. 94, group 1 cannot be designated because work 8 outside the group is inserted between works 2 and 12. This is because work 8 must be executed after work 10 2 and before work 12 and cannot be executed when work 8 is assigned to a station different from that for works 2 and 12. To designate works 2 and 12 to the same group, work 8 inserted therebetween must also be designated to the same group.

15 As a result of such composition, according to composition plan 1, works Nos. 1, 2, and 3 are assigned to station 1 (St1), and works Nos. 4, 5, and 6 are assigned to station 2 (St2). On the other hand, according to composition plan 2, works Nos. 1, 2, and 8 are assigned to station 1 (St1), 20 and works Nos. 3, 4, and 5 are assigned to station 2 (St2).

A user interface as a composition editing means as in simple composition as shown in Fig. 72 is prepared for each of the composition plans composed by parallel division. Fig. 72 shows a user interface for composition plan 1, and 25 Fig. 73 shows a user interface for composition plan 2.

<Details of Control Procedure>... Work Assignment System

The work assignment system 2802 prepares two load sources of work data to be composed, i.e., the manhour setting file 3601 (standard manhour setting system 2801 side) and the composition table file 6400 (work assignment system 2802 side), as shown in Fig. 64. More specifically, when the work assignment system 2802 is activated, and the "load new file (N)" menu of the file menu is selected, data can be loaded from the manhour setting file 3601. When the "open (O)" menu of the file menu is selected, a target work file can be opened from the composition table file 6400.

Fig. 74 shows a user interface window for a data load when the "open new file (N)" menu is selected.

In this work assignment system 2802 as well, a set of work data linked by directories having a hierarchical relationship

genre → representative model → target model → composition

is defined, as in the work standard creation system 2800 and standard manhour setting system 2801. In other words, the set of work data linked to each other by the above hierarchical relationship defined by the work standard creation system 2800 is succeeded by the manhour setting file 3601 of the standard manhour setting system 2801 while holding the hierarchical relationship.

The hierarchical relationship and contents of work data succeeded by the manhour setting file 3601 are edited

or worked by the standard manhour setting system 2801. Work data as the result must also be succeeded by the work assignment system 2802 from the standard manhour setting system 2801. For this purpose, the work assignment system 5 2802 has a user interface capable of designating one or more or all of the four layers as data load targets from the standard manhour setting system 2801.

As such a user interface, for example, to load data from the manhour setting file 3601 in units of genres, the 10 name of the genre is input to a field 7401, as in the example shown in Fig. 74. In a field 7402, a set of all work data at the "genre" level present in the field 6301 of the standard manhour setting system 2801 is displayed.

In the example shown in Fig. 74, bubble-jet printer 15 (BJ), facsimile apparatus (FAX), laser beam printer (LBP), and the like are displayed as genres. When one genre is selected in the field 7401, and an "OK" button 7408 is clicked, a set of all work data belonging to the genre is downloaded from the manhour setting file 3601.

If the user wants download in units of "representative 20 models", the name of a genre to which the representative model belongs is input to the field 7401. Then, the names of all representative models belonging to the selected genre are displayed in a field 7404. When, of these displayed names, 25 the name of a desired "representative model" is double-clicked, the name is copied to a field 7403, and then,

the "OK" button 7408 is clicked.

If the user wants download at the "target model" level, the name of the target model is input to a field 7405, or a field 7406 is selected, and then, the "OK" button 7408 is  
5 clicked.

The work assignment system 2802 has a user interface capable of setting to download a plurality of "components" at the "component" level at once. In a field 7407 shown in Fig. 74, the names of all components belonging to a "target model" of a "representative model" in a "genre" are displayed,  
10 so a plurality of "components" can be selected while designating the download order thereof. To designate the download order, sequential numbers are input to an order column 7409 of the "components" selected by clicking of the  
15 mouse.

The user interface shown in Fig. 74 and, more particularly, arbitrary setting at the component level has the following advantage.

For example, assume that work data of a model named  
20 "X" is stored in the manhour setting file 3601, and components "A", "B", "C", "D", "E",... belong to the model "X", as shown in Fig. 75. When the user interface shown in Fig. 74 is used,  
model "X1" (including the components "A", "B", and  
25 "C") ,  
model "X2" (including the components "A", "B", and  
"D") ,

model "X3" (including the components "B", "C", and "A"), ...

can be downloaded from the model "X", as shown in Fig. 75. When these new models "X1", "X2", and "X3" are downloaded,  
5 they are registered in the work assignment system 2802 as new directories. The reason for this is as follows. Since the work composing operation is close to the site of assembly, it is preferable to allow the user to determine work composition with components more appropriate to the site of  
10 assembly and also, even for the same model, define work composition whose components are easily changed.

To create a plurality of different "model" directories from one "model" directory, the work assignment system 2802 adds "?n" (n is a number) to the directory name of the original  
15 "model".

Fig. 76 shows a user interface window for opening an existing file in the composition table file 6400. In the work assignment system 2802, to open an existing file, files are selected in units of "target models". The "target model"  
20 includes the "target model" defined in the field 7405 in Fig. 74 and the "target models" newly automatically defined in Fig. 75.

The user clicks on one of a plurality of "target models" displayed in the field 7601 using the mouse or inputs the  
25 name of a desired "target model" to a field 7602. The "revision number" of the selected "target model" is

displayed in a field 7604. Whether the composition data input window or composition data editing window for the selected "target model" is to be displayed is selected by check buttons 7605.

5 Referring to Fig. 77, work data loaded to the memory of the work assignment system 2802 by the above-described download or file open operation are displayed in units of "target models".

More specifically, the work data are displayed as a  
10 list in a field 7706. The name of the target model is displayed in a field 7701, the file name is displayed in a field 7702, and the revision number is displayed in a field 7703. A "total work count"  $N_{\text{t}}$  for the "target model" is displayed in a field 7707, and the total manhour is displayed  
15 in a field 7708.

The number or name of a work selected in the field 7706 with the mouse is displayed in a field 7705. The total manhour in composition is displayed in a field 7709.

An input for defining conditions for composition is  
20 done in a window 7710. Bibliographic data of the composition result are displayed in a window 7720.

Data related to the above-described equation (1) are input to the input window 7710. More specifically, the user inputs the number of units (the number of products)  $U$  to be  
25 produced by one crew as a set of a plurality of operators per day to a field 7710a, time (i.e., operation time of each

station) H (unit: RU) obtained by subtracting an exclusive time such as a break from one-day working time of one crew (a set of a plurality of operators) to a field 7710b, and the target composition efficiency (i.e., expected  
5 composition efficiency) E to a field 7710c. As the total manhour in the composition, which is represented by equation (1), the total manhour (field 7709) not input by the user but calculated by the system is used, as described above.

When "calculate" button 7710d is clicked, the number  
10 of stations  $N_{st}$  is calculated in accordance with equation (1), and the pitch time  $T_p$  is calculated in accordance with equation (2) on the basis of the conditions input to the window 7710.

The number of stations  $N_{st}$  is automatically calculated in accordance with  $N_{st} = (U \times WF) / (H \times E)$  (equation (2)) and  
15 displayed in a field 7720a when the value is rounded down or in a field 7720b when the value is rounded up, together with the composition efficiency. That is, when the number of stations  $N_{st}$  is rounded down, the composition efficiency becomes higher than the target composition efficiency (field 20 7710c), and when the number of stations  $N_{st}$  is rounded up, the composition efficiency becomes lower than the target composition efficiency.

The pitch time  $T_p$  is displayed in a field 7720d.

The user can edit the composition in units of works  
25 while looking at the window shown in Fig. 77. The editing commands are "divide", "integrate", "insert before", "insert

after", "delete", "change work order", "in composition", and "outside composition". These editing menus are done from the editing menu provided by the window system or by selecting a desired work with the mouse and clicking the right button  
5 of the mouse.

To "divide" a work means that one unit work is divided into two unit works. The manhour value of each divided unit work is "0". The number of each divided element work has a subnumber. The name of each divided element work has an  
10 indent.

To "integrate" works means that two element works are integrated to one unit work. The manhour of the integrated unit work corresponds to the sum of manhours of the respective element works as integration targets.

15 With the "insert before" menu for a work, a work designated by the dialog shown in Fig. 78 is inserted before a selected work. More specifically, the name of work to be inserted is written in a field 7801, and a temporary manhour value is written to a field 7802.

20 The "insert after" menu for a work is almost the same as the above "insert before" menu.

With the "change work order" menu, the positions of two works are exchanged.

25 With the "in composition" or "outside composition", it is determined whether a work is to be subjected to composition or excluded from the composition targets.

The operation of composing all works of the "target model" is started by clicking on an "execute composition" start button 7730.

Fig. 79 is a flow chart for explaining the control procedure of composition. In step S790, counters i, j, and k for work are initialized to "1", and a register T for storing the accumulation time of manhours for each station is initialized to "0".

In step S791, data of a work  $w_j$  (manhour  $t_j$ ) indicated by the counter  $j$  is extracted. In step S792, the manhour  $t_j$  is accumulated to the time register T. In step S793, the counter  $j$  is incremented by one. In step S794, it is determined whether the manhour value accumulated in the time register T exceeds the pitch time  $T_p$ . If NO in step S794, the flow returns to step S791 to repeat the above-described operation.

That the accumulated manhour value T of manhours  $t_k$  to  $t_j$  exceeds the pitch time  $T_p$  means that works  $w_k$  to  $w_j$  should belong to a station  $S_{ti}$ , so the works  $w_k$  to  $w_j$  are assigned to the station  $S_{ti}$ . In step S796, the counter i is incremented to prepare for setting the next station. In step S797, the counter k is returned to "j", and the time register T is initialized to "0".

In step S798, it is determined whether the counter value j representing the work number exceeds the total number of works  $N_w$ . If YES in step S798, the processing is ended.

The control procedure shown in Fig. 79 determines assignment of works to stations with priority on the manhour.

That is, assignment is determined that the accumulated manhour value  $T$  preferentially should not exceed the pitch time  $T_p$ . The number of assigned stations may eventually be larger than the number of stations  $N_{st}$  set as a target, and if so, the composition efficiency changes accordingly.

For work assignment, a determination method with priority on the number of stations (Fig. 95) or an assignment determination method based on the accumulated manhour value (Fig. 96) can be proposed as a modification.

The assignment method shown in the flow chart of Fig. 95 gives priority on that the total number of stations to be assigned works should not exceed the upper limit value  $N_{st}$ . For this purpose, variables, a parallel number  $n_i$  and total accumulated parallel sum number  $n_0$ , are newly introduced, unlike the control shown in Fig. 79. The parallel number  $n_i$  is the number of stations that can be parallel-operated in the stations  $i$ .

In step S950, the counters  $i$ ,  $j$ , and  $k$  for work are initialized to "1", the register  $T$  for storing the accumulated time of manhours for each station is initialized to "0", and the total accumulated parallel sum number  $n_0$  is initialized to "0". In step S951, data of the work  $w_j$  (manhour  $t_j$ ) indicated by the counter  $j$  is extracted. In step S952, the manhour  $t_j$  is accumulated to the time register  $T$ .

That is, the accumulated manhour value of the manhours tk to tj is stored in the time register T. In step S953, the counter j is incremented by one. In step S954, it is determined whether the manhour value for the station i  
5 exceeds the pitch time  $T_p$ . Since the station i is allowed to parallel-operate  $n_i$  stations in advance, and the manhour that can be assigned to the station i is  $T_p \times n_i$ , more works can be assigned to the station i when

$$T < T_p \times n_i \quad \dots (4)$$

10 When

$$T \geq T_p \times n_i \quad \dots (5)$$

no more works can be assigned to the station i. In step S954, such determination is done. In step S955,

$$i + n_0 < N_{st} \quad \dots (6)$$

15 is determined to confirm that the total number of stations assigned works does not exceed the upper limit value  $N_{st}$ . More specifically, when equation (5) holds for a certain station i (the assigned manhour T exceeds the pitch manhour ( $T_p \times n_i$ ) considering parallel operation), the station  $St_i$  is newly  
20 set in step S956 unless the total number of stations ( $i + n_0$ ) set so far exceeds the upper limit value  $N_{st}$ .

The purpose of step S955 is to prevent the number of assigned station from exceeding  $N_{st}$  by assigning works beyond the pitch manhour  $T_p$  to the final station.

25 If YES in step S955, the counter i is incremented in step S957 to prepare for setting the next station, and the

register n0 is updated in accordance with

$$n0 = n0 + (ni - 1) \quad \dots (7)$$

where ni in (ni - 1) is the parallel number defined in advance for incremented i, i.e., the station i to be taken into

5 consideration next. Hence, n0 in equation (7) is the accumulated value of parallel numbers set for the first to (i-1)th stations. In step S958, the counter k is set to "j", and the time register T is initialized to "0".

In step S959, it is determined whether the counter  
10 value j representing the work number exceeds the total number of works  $N_{st}$ . If YES in step S959, the processing is ended.

As described above, in the control procedure shown in Fig. 95, to prevent the number d of assigned stations St from exceeding the number of stations  $N_{st}$  set as a target, all works  
15 remaining at the time of end of assignment to the station (i - 1) are assigned to the final station (i.e., station i). With this method, the number of assigned stations is prevented from exceeding  $N_{st}$  by assigning works beyond the pitch manhour  $T_p$  to the final station.

20 However, in the method shown in Fig. 95, the load (manhour) may be concentrated to the final station. To prevent this, the assignment method shown in the flow chart of Fig. 96 has as its object to keep the number of stations  $N_{st}$  set as a target and distribute the load (manhour) without  
25 concentrating the load to the final station such that the variation in manhour between the stations is easily evened.

To do this, unlike the control shown in Fig. 95, let  $T_i$  be the manhour to be assigned to the station  $i$ , and  $T_0$  be the accumulated manhour assigned to all stations assigned works. Additionally, a new variable, station manhour  $T_A$  is  
5 introduced.

The station manhour average value  $T_A$  is defined by

$$T_A = WF/N_{st} \quad \dots (8)$$

When equations (1) and (2) are taken into consideration.

$$T_A = E \times T_p \quad \dots (9)$$

10 In the control procedures shown in Figs. 79 and 95, the pitch time  $T_p$  defined by equations (1) and (2) is used as a reference for determination whether the station  $St_i$  is to be set. However, the control procedure shown in Fig. 96, the station manhour average value  $T_A$  defined by equation (8)  
15 is used as data for determination whether the station  $St_i$  is to be set.

In step S960 of Fig. 96, the counters  $i$ ,  $j$ , and  $k$  for work are initialized to "1", the register  $T$  for storing the accumulated time of manhours for the station  $i$  is initialized  
20 to "0", the total accumulated manhour  $T_0$  is initialized to "0", and the total accumulated parallel sum number  $n_0$  is initialized to "0". In step S961, data of the work  $w_j$  (manhour  $t_j$ ) indicated by the counter  $j$  is extracted.

In step S962, the manhour  $t_j$  is accumulated to the time  
25 register  $T$ . That is, the accumulated manhour value of the manhours  $t_k$  to  $t_j$  for the station  $i$  is stored in the time

register T. In step S963, the manhour  $t_j$  is accumulated to the time register T0 to update the total accumulated manhour T0. In step S964, the counter j is incremented by one. In step S964, it is determined whether

$$5 \quad T_0 > T_{\text{c}} \times (i + n_0) \quad \dots (10)$$

As described above,  $(i + n_0)$  is the total number of stations assigned works so far in determining whether the  $i$ th station is to be set. For this reason, when equation (10) holds, all works corresponding to the accumulated manhour  $T_i$  can be assigned to the station  $S_{ti}$  in step S965.

In the method shown in Fig. 95, assignment is determined on the basis of the pitch time  $T_p$ , that is uniform to all stations. However, in the method shown in Fig. 96, the accumulated value based on the manhour average value  $T_{\lambda}$  is used as a reference. Hence, works are prevented from being excessively assigned to a specific station.

Fig. 80 shows an example in which the composition  
created by the control procedure shown in Fig. 79 is  
displayed. As characteristic features of the work  
assignment system 2802, composition can be easily corrected,  
as described in association with Fig. 69, and also,  
correction can be done while confirming the correction  
process in real time. Referring to Fig. 80, the work  
assignment states of five out of the total of  $N_{st}$  stations  
are displayed.

The number of stations for display is limited to five

due to a limitation on the screen size of the display unit.

The total manhour value of each station is stored and displayed in a field 8004.

The total manhour of each station is displayed in a  
5 bar graph (8006). The composition efficiency is displayed  
in a field 8007.

Reference numeral 8008 denotes a display window of works outside the composition; and 8009, a display example of a menu displayed by clicking the right button of the mouse.

10 The work outside the composition and the works listed for the station can be exchanged.

The editing commands "divide", "integrate", "insert before", "insert after", "delete", "change work order", "in composition", and "outside composition" are allowed for  
15 works displayed in the composition target definition window shown in Fig. 77. As in this window, editing commands "divide", "integrate", "insert before", "insert after", "delete", "change work order", "in composition", and "outside composition" are also prepared for the works listed  
20 for the five stations displayed on the window shown in Fig. 80. In the compositor data correction window, the "change work order" menu is displayed as a "move" menu.

The function of "dividing" a work in the composition result will be described first.

25 This function is necessary when the user looks at the graph in Fig. 80, finds that the manhour of a specific station

is particularly larger than that of the remaining stations, and wants to divide the specific work. In this case, one of the divided subworks is left to the station, and the other subwork is moved to another station. "Divide" and "move" in 5 this example will be described with reference to Figs. 81 to 83.

Assume that a plan as shown in Fig. 81 is obtained by a composing operation. As is apparent from the example shown in Fig. 81, the total manhour of station 1 is larger than 10 that of station 2 by 38 RU. The cause for this is the work "A4" assigned to station 1, as is known from the work table.

The user selects the work "A4" with the mouse, displays the menu by clicking the right button of the mouse, and selects the "divide" menu (or double-clicks). The work "A4" is 15 divided into works "A4-1" and "A4-2" each having a 1/2 manhour, as shown in Fig. 82. The user selects the "move" menu to move the work "A4-2" from station 1 to station 2. The result of movement is reflected to the graph, as shown in Fig. 83.

For the remaining functions, e.g., "integrate", 20 "insert", and "delete" of a work as well, a desired work is selected with the mouse, and the menu is selected (for "integrate", the menu can also be double-clicked), thereby reflecting the editing result to the graph.

The editing function in the work assignment system 2802 25 includes not only editing in units of work but also editing in units of stations. The functions are "delete", "insert",

"add", and "parallel integrate" of a station.

With "delete" of a station, a station which has become empty as a result of "move" of works is deleted. As a detailed user's operation, an empty station is selected in the window 5 shown in Fig. 80. The right button of the mouse is clicked to display the "delete" menu of the station, and the menu is selected, thereby deleting the station. A station can also be added to add a work.

With "insert station", an empty station is inserted 10 between two stations. As a detailed user's operation, an arbitrary work in the station located on the front side is selected with the mouse. Next, the right button of the mouse is clicked to display the "insert station" menu, and the menu is selected. With this operation, an empty station is 15 inserted.

With "add station", a station is added next to the station as an addition target. As a detailed user's operation, an arbitrary work in the station as an addition target is selected with the mouse. Next, the right button 20 of the mouse is clicked to display the "add station" menu, and the menu is selected. With this operation, an empty station is added. The newly created station is additionally displayed after the station as the addition target. Since the added station has no work, a work is moved from another 25 station.

With "parallel-operate stations", to allow work by a

plurality of operators, a work in a station is divided into stations equal in number to the plurality of operators. As a detailed user's operation, a desired station is selected with the mouse, the right button of the mouse is clicked to 5 display the "parallel integrate" menu, and the menu is selected. Then, a dialog shown in Fig. 84 is displayed. The number of stations to be divided is written in a field 8402.

Fig. 85 shows an example of station division before parallel operation. In this example, the number of works 10 assigned to the station St2 displayed as "operator 2" is large, and the time is also long. With the above parallel operation, station 2 is divided into stations St2-1 and St2-2, as shown in Fig. 97.

For the illustrative convenience, St1 expressed as 15 "operator 1" in Fig. 85 corresponds to St1 expressed as "operator 1" in Fig. 97. However, St3 expressed as "operator 3" in Fig. 85 corresponds to St3 expressed as "operator 4" in Fig. 97. In addition, St4 expressed as "operator 4" in Fig. 85 corresponds to St4 expressed as "operator 5" in 20 Fig. 97, and St5 expressed as "operator 5" in Fig. 85 corresponds to St5 expressed as "operator 6" in Fig. 97.

Addition of a station (or addition of a work) at the time of composition is effective when a station (or work) for check (inspection) is to be added. Whether the 25 inspection process is necessary can hardly be determined by the work standard creation system 2800 for defining the work

or the standard manhour setting system 2801 for defining the manhour. Such determination is necessary and possible when the work assignment system 2802 is operated. When a previous or subsequent station as an addition target is designated  
5 with the mouse, and the "add" station menu is selected, a newly created empty station is displayed after the addition target station.

<Modification to Composition>

The form of composition is not limited to the above  
10 examples.

For example, there may be a single work requiring a large manhour. Even when such a work is present, composition can be theoretically executed in accordance with equations (1) and (2). However, the time for the single work having  
15 a large manhour exceeds the pitch time  $T_p$ . For example, one station is assigned to the single work, like station 2 shown by 8601 in Fig. 86.

The display shown on the upper side (8601) of Fig. 86 is not preferable because the window is inefficiently  
20 occupied. In the work assignment system 2802, letting  $n$  be a value obtained by dividing the total manhour in the station assigned such a single work having a large manhour by a number (to be referred to as a unit manhour hereinafter) obtained by multiplying the pitch time  $T_p$  by a predetermined value (a  
25 constant can be used), and rounding up the quotient,  $n$  operators are assigned to the station. The graph display of

the manhour of such a station has a width n times the normal bar width. The width of the station 2 bar in Fig. 86 is doubled (8602 in Fig. 86). With this display, the user can understand at a glance that the station has a single work  
5 with a large manhour, and its manhour represented by a multiple of the above "unit manhour".

Only a specific user can perform the composing operation. The user interface window shown in Fig. 87 is an input window for checking the operator has a right for  
10 composition. The operator code is input to a person name code column 8701, the name of the operator is input to a column 8702, the position is input to a column 8703, the password is input to a column 8704, and the authority is input to a column 8705. The input data are collated with a personnel  
15 database, and only when the data match, an access right is given.

Fig. 88 shows the data upload from the work assignment system 2802 to the work standard creation system 2800 when the work standard creation system 2800, standard manhour  
20 setting system 2801, and work assignment system 2802 have standalone structures.

As described above, the work standard creation system 2800 of this embodiment can attach voice or image data to a work standard. In the above embodiment, the work standard  
25 creation system 2800, standard manhour setting system 2801, and work assignment system 2802 build a client/server

database system, as shown in Fig. 1. For this reason, the download or upload by batch operation of work standard data is unnecessary between the work standard creation system 2800, standard manhour setting system 2801, and work assignment system 2802.

However, when work standard creation system 2800, standard manhour setting system 2801, and work assignment system 2802 have standalone structures, as shown in Fig. 88, the data download or upload between the subsystems is necessary. In this case, it is inefficient to download or upload image data or voice data created by the work standard creation system 2800.

In the modification shown in Fig. 88, download or upload is limited to download or upload of minimum necessary data. Merging between image data or voice data and work standard data composed by the work assignment system 2802 is executed by the work standard creation system 2800. This shortens the time required for the download or upload.

In addition, the work standard creation system 2800 can be connected to each station in the workshop through a LAN (communication network), so work standard data, including image data or voice data, can be downloaded to the workstation of each station through the LAN.

#### <Other Modifications>

M-1: The above-described embodiment is constructed under the client/server environment, as shown in Fig. 1.

However, the present invention can also be applied to a standalone environment in a single computer system. In this case, the work standard creation system 2800, standard manhour setting system 2801, and work assignment system 2802 5 operate in the computer system.

M-2: In the above-described embodiment, various files are created in each system, and the formats of these files can be set in various ways. For example, these files need not always be so-called permanent files always stored in an 10 external auxiliary storage device such as a disk and can be so-called view files which are present only on the main memory. This is because many files are temporarily created for the purpose of display (view).

[Other Embodiment]

15 The object of the present invention can also be achieved by supplying a storage medium (or recording medium) in which software program codes for realizing the functions of the above-described embodiment are recorded to an apparatus which operates as the above-described subsystem or the server/client, 20 and causing the computer (or a CPU or an MPU) of the system or apparatus to read out and execute the program codes stored in the storage medium. In this case, the program codes read out from the storage medium realize the functions of the above-described embodiment by themselves, and the storage 25 medium storing the program codes constitutes the present invention. The functions of the above-described embodiment

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are realized not only when the readout program codes are executed by the computer but also when the OS (Operating System) running on the computer performs part or all of actual processing on the basis of the instructions of the program  
5 codes.

The functions of the above-described embodiment are also realized when the program codes readout from the storage medium are rewritten in the memory of a function expansion board inserted into the computer or a function expansion unit connected to  
10 the computer, and the CPU of the function expansion board or function expansion unit performs part or all of actual processing on the basis of the instructions of the program codes.

As has been described above, according to the assembly  
15 information management system of the above-described embodiment, management can be more efficiently executed using work standard data suitable for computer processing.

In addition, according to the work standard creation system of the above-described embodiment, work standard data  
20 suitable for computer processing can be created.

Furthermore, according to the automatic manhour setting system of the above-described embodiment, the manhour can be quickly set for a work standard by computer processing.

25 As many apparently widely different embodiments of the present invention can be made without departing from the spirit

and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.